40 Ecology and Nature Conservation

This chapter provides a description of existing ecological conditions in the vicinity of the Fastlink section of the proposed scheme, assesses the likely impacts on ecological receptors, and proposes mitigation to ameliorate these potential impacts. The Fastlink section of the proposed scheme would pass through a diverse range of habitats of varying sensitivity. Although the majority of the proposed scheme would pass through an agricultural landscape of relatively low ecological value, important habitats are present at a number of locations, including Limpet Burn, Megray Wood, Fishermyre and the Burn of Muchalls.

The main potential ecological impacts would be likely to occur at Fishermyre, which is an important area supporting modified bog, heathland, wet woodland and marsh habitats, as well as protected species including otters, bats, birds and water voles. In this area, the proposed scheme would result in habitat loss, fragmentation, severance and hydrological damage to peat-based habitats. Habitat loss and fragmentation impacts are likely to be most important where the proposed scheme would affect burns and associated riparian habitat that form important wildlife corridors. The most important of these are Limpet Burn and the Burn of Muchalls, where there are likely to be significant impacts on birds and otters. Additional impacts would be associated with the localised fragmentation of woodland and heathland habitat and where the proposed scheme would potentially result in the fragmentation of bat flight routes and foraging areas.

In general, residual ecological impacts as a result of the proposed scheme are not expected to be significant. At several locations, licences will be required for a number of protected species, including the closure of badger setts, the exclusion/disturbance of otter holts/couches, and the exclusion of bat roosts.

40.1 Introduction

40.1.1 For the purposes of this ES, ecology is defined as the scientific study of the processes that influence the distribution and abundance of organisms, and the interactions between those organisms and their environment. Nature conservation is the maintenance of viable populations of fauna and flora and the habitats and communities to which they belong.

40.1.2 The objectives of nature conservation are the:

- maintenance of diversity and landscape character, including wildlife communities and important geological and physical features; and
- maintenance of viable populations of native species throughout their traditional distribution range, and the improvement of the status of rare or endangered species.

40.1.3 This chapter is concerned with the impacts of the proposed scheme on habitats and species present within the Fastlink study area. Technical assessment reports supporting this chapter are provided as appendices in Volume 11, Part D of the Environmental Statement (ES).

40.1.4 Cumulative impacts, combining the predicted impacts for all habitats and species over the entire AWPR proposed route, are described in Volume 5, Part E of the ES.

40.1.5 To aid the interpretation of the assessment, the study area has been sub-divided based upon habitat boundaries either man-made such as existing roads or due to habitat changes such as wooded areas changing into intensive agriculture. The sections for the Fastlink are as follows:

- Section FL1: Stonehaven to Howieshill (ch0-3200);
- Section FL2: Howieshill to Cookney (ch3200-6300); and
- Section FL3: Cookney to Cleanhill Junction (ch6300-10200).

Legislative and Policy Framework

40.1.6 Relevant nature conservation legislation and policy are described in detail in Chapter 10 (Ecology and Nature Conservation), Volume 2, Part B.

40.2 Approach and Methods

Overview of Approach

40.2.1 The DMRB Stage 3 ecology surveys and assessment of impacts for the AWPR involve a process of Ecological Impact Assessment (EcIA) that is based on a matrix approach to Impact Assessment. This system of EcIA has been previously adapted for road construction projects and is recommended in Transport Appraisal Guidance documents such as Scottish Transport Appraisal Guidance (STAG) and the Highways Agency's guidance WEBTAG.

40.2.2 The matrix approach to EcIA involves a three stage approach to impact assessment:

- firstly, all ecological features are evaluated in terms of their ecological importance and/or conservation value;
- the magnitude of the impacts on these features is assessed according to a simple scale; and
- finally, the significance of the impacts is determined by combining the information on the ecological importance of the feature with the magnitude of the impacts upon it.

40.2.3 The Ecological Impact Assessment (EcIA) was undertaken in accordance with the Design Manual for Roads and Bridges (DMRB) Volume 10 and 11 (Highways Agency, 2005) and the Environmental Impact Assessment (Scotland) Regulations 1999, along with cognisance of draft Institute of Ecology and Environmental Management (IEEM) guidelines 2002.

Scope of Assessment

40.2.4 The scope of this ecology assessment was determined through scoping and consultation with statutory and non-statutory bodies, and in accordance with client instruction and programme. The relevant information is summarised in this chapter, however further details of the EIA consultation process and respondees are provided in Chapter 6 (Scoping and Consultation).

40.2.5 Detailed ecological assessments were undertaken for habitats and for a range of rare or protected species, as agreed with SNH. Assessment results are summarised within this chapter and provided in full in the following technical appendices:

- A40.1 – Terrestrial Habitats;
- A40.2 – Badger (Confidential Document);
- A40.3 – Bats;
- A40.4 – Breeding Birds;
- A40.5 – Otter;
- A40.6 – Red Squirrel;
- A40.7 – Water Vole;
- A40.8 – Deer;
- A40.9 – Freshwater Ecology; and
- A40.10 – Wintering Birds.

40.2.6 In addition to the species covered in the technical appendices, habitat evaluation was also undertaken for the following species and assemblages:

- Amphibians;

- Brown Hare;
- Reptiles;
- Terrestrial Invertebrates; and
- Water Shrew.

40.2.7 To minimise the need for cross-referencing, these evaluations are not reported in separate technical appendices however, the information is presented in this chapter. As no further information is provided on these species/assemblages, the amount of detail provided in this chapter is slightly greater than that warranted by their relative importance compared to the various protected species that are reported in the detailed technical appendices and summarised in this chapter.

40.2.8 Roe deer do not have any specific legal protection for nature conservation and no ecological impact assessment has been undertaken on them. Appendix A40.8 reports the results of consultation and survey to establish baseline conditions for deer in the vicinity of the proposed scheme. It also provides a risk assessment that identifies key areas where there is a risk of deer/vehicle collisions. The data on deer have been included in the context of a potential traffic hazard associated with the proposed scheme, rather than because of their nature conservation value. Therefore, they have not been assessed in this chapter.

Baseline Conditions

40.2.9 All ecological assessments were undertaken by Jacobs, with the exception of bird and bat surveys, which were undertaken by Mackenzie Bradshaw Environmental Consulting (MBEC). Electric-fishing surveys were undertaken by the Dee District Salmon Fishery Board (DDFSB). The names and qualifications of the ecology team are provided in Table 40.1.

40.2.10 Ecological baseline conditions were identified using two methods, described in more detail below: consultation of statutory and non-statutory organisations and of recognised publications; and specialist field survey.

Table 40.1 – Lead Surveyors

Responsibility	Name and Relevant Qualifications
Ecology Team Leader	Rebecca Hewlett BSc (Hons) MSc MIEEM 2003-2006 Peter Gilchrist PhD BSc (Hons) PGC Res Sup MIEEM CEnv 2006-present
Ecology Team Leader	Jon Huckle BSc (Hons) MSc PhD MIEEM 2003-2006
Ecology Assessment	Martina Girvan BSc (Hons) MSc PhD MIEEM 2005-2007
MBEC Leader	Paul Bradshaw BSc (Hons) MSc MRes
Survey Scoping and Coordination	Graham Rankin BSc (Hons) MSc MIEEM
Phase 1 Habitat and NVC	Chris Smillie BSc (Hons) MSc MCSM PhD MIEEM
Badger	Jon Guarnaccio BSc (Hons) MSc MIEEM
Bats (MBEC)	Nicola Tallach BSc (Hons) BTEC HNC MIEEM Claire Hopkins BSc (Hons) MSc AIEEM Licenced Bat Worker (Jacobs)
Breeding Birds (MBEC)	David Coote MPhys MSc Graham Rankin BSc (Hons) MSc MIEEM (Jacobs)
Wintering Birds	Graham Rankin BSc (Hons) MSc MIEEM Colin Nisbet BSc (Hons) MSc
Otter	Claire Hopkins BSc (Hons) MSc AIEEM
Red squirrel	Kate Finlinson BSc (Hons) MSc AIEEM
Water Shrew and Vole	Richard Roe BSc (Hons) MSc MIEEM
Amphibians and Reptiles	Chris Kerfoot BSc (Hons) International MSc AIEEM
Deer	Alastair Miller BSc (Hons) MSc AIEEM
Brown Hare	Alastair Miller BSc (Hons) MSc AIEEM
Freshwater Habitat	Rachel Wilson BSc (Hons) MSc AMIBIOL LMIFM
River Habitat Survey	Simon Holden BSc (Hons) MSc Accredited River Habitat Surveyor AIEEM
Freshwater Pearl Mussel	Rachel Wilson BSc (Hons) MSc AMIBIOL LMIFM Licensed Pearl Mussel Worker
Terrestrial Invertebrates	Claire Beverley BSc (Hons) MSc PhD MIEEM
Fish	Gillian McCoy BSc (Hons) MSc PhD MIEEM
Electric fishing (DDSFB)	Adrian Hudson BSc (Hons) SFCC Stage 2

Consultation and Literature Review

40.2.11 A full list of the organisations consulted is presented in Chapter 6 (Scoping and Consultation). The following organisations responded with regard to ecology and nature conservation and either provided data or assisted in the identification of key issues. A list of acronyms is provided in the reporting for the Northern Leg of the proposed scheme in Chapter 10 (Ecology and Nature Conservation):

- Aberdeen Bat Group;
- Aberdeen City Council: City Development Services;
- Aberdeenshire Council: Planning and Environmental Services;
- Aberdeen Countryside Project;
- Centre for Ecology and Hydrology;
- Forestry Commission;
- Grampian Badger Surveys;
- Grampian Fungus Group;
- National Farmers Union of Scotland;
- North East Scotland Biological Records Centre (NESBReC);

- North East Scotland Biodiversity Partnership Coordinator;
- NES Local Biodiversity Action Plan;
- Royal Society for the Protection of Birds;
- Scottish Executive Development Department Planning Division: Wildlife and Habitats Division; and
- Scottish Ornithologists' Club (SOC).

40.2.12 SNH Area Office: Aberdeen Responses are summarised in Chapter 6 (Scoping and Consultation), with further details provided in Appendix 6.1. The responses of specific relevance to ecology are identified within the relevant section of this chapter and appendices as appropriate.

40.2.13 Three key publications were used extensively as a guide to the character and distribution of nationally and locally important habitats and species within Aberdeenshire, and particularly within the study area:

- UK Biodiversity Action Plan (UK BAP) as set out in the Biodiversity Steering Group Report (Vol. 2; 1995) – information included on the 45 habitats and 391 species included in the UK BAP due to rarity, decline or other importance;
- North East Scotland Local Biodiversity Action Plan (NES LBAP) – information on the habitats and species identified as local priorities within North East Scotland; and
- North East Scotland Biodiversity Audit (Alexander et al., 1998) – information on status and range of species and habitats in Aberdeen city, Moray and Aberdeenshire.

40.2.14 In addition to these documents, a review was also undertaken of relevant literature on species and habitat abundance, distribution and susceptibility to impacts. Aerial photographs from spring 2006 were also used to inform interpretation of results. Best practice guidance was also taken into account during the formulation of appropriate survey methods, as referenced for each field survey described below and in Appendices A40.1 to A40.10.

40.2.15 A search of the internet sources of information was also undertaken as part of the literature review including: SNH Lowland Raised Bog Inventory Data, the UK BAP, the North East of Scotland Biodiversity Audit, NES LBAP priority and locally important habitats and species, as well as citations for sites designated at the local, national and international levels.

40.2.16 Information collected during surveys undertaken for previous route options was also reviewed and utilised where appropriate. When such information has been used it is stated in the baseline information.

Field Survey

40.2.17 The study area for each survey generally extended to a minimum of 500m either side of the centreline of the proposed scheme (i.e. a 1km wide study corridor). Study corridors referred to below were centred on the proposed alignment unless otherwise stated. Variation in study corridor width was dependent on the habitat or target species as identified in the methods summary below. This was consistent with best practice as determined by the appropriate governing or professional body (including the Scottish Environment Protection Agency [SEPA] and the Institute of Ecology and Environmental Management [IEEM]) and as described in the Design Manual for Roads and Bridges (DMRB) Volume 11 and Volume 10 (Highways Agency, 2001).

40.2.18 For this report, ecological survey methods followed the IEEM 2006 guidelines, whereas the evaluation followed the IEEM 2002 guidelines for reasons of consistency. In addition to the IEEM 2006 guidelines, the ecological survey methods followed current best practice, based on the DMRB Volume 11 and Volume 10 (Highways Agency, 2001). Prior to undertaking fieldwork, the approach and methods were agreed with SNH following consultation and submission of an ecological scoping report (Jacobs, 2006).

40.2.19 Brief summaries of the methods used are presented below, with full details provided in the respective technical reports (Appendices A40.1 to A40.10).

40.2.20 In general, survey methods used for the Fastlink section of the AWPR were the same as those used for the Northern Leg section, with some exceptions that were agreed with SNH in advance. These exceptions were due to survey methods being refined during the northern surveys in order to improve survey efficiency, and to changes in accepted survey standards between 2004 and 2006. Fastlink section surveys that were substantially different from the Northern Leg surveys were:

- bat surveys were modified by a shift in the emphasis of the habitat and commuting route survey from a transect approach to an assessment targeted on key habitat areas;
- water shrew surveys were substantially scaled down as the baited plastic tube surveys that were carried out for the Northern Leg yielded no results. Habitats were still assessed in terms of suitability for water shrew and evaluated accordingly;
- amphibian surveys were not undertaken as no protected species were found in the Northern Leg study area. Habitats were still assessed in terms of suitability for amphibians and evaluated accordingly;
- reptiles were extensively surveyed for in the Northern Leg and no species were recorded, although previous biological records show a number of reptiles to be present within the study area. Therefore, although no surveys were conducted in the Fastlink study area, habitats were assessed in terms of suitability for reptiles and evaluated accordingly;
- freshwater macroinvertebrates were sampled once for the Northern Leg section, whereas two sampling occasions were planned for the Fastlink in order to bring the sampling protocol in line with SEPA's monitoring;
- fish surveys were expanded in the Fastlink following feedback from SNH. In contrast to the Northern Leg section, where existing data from the Don Salmon Fisheries were reported, electric fishing surveys were conducted by the Dee District Salmon Fishery Board to inform the ecological evaluation; and
- detailed freshwater pearl mussel surveys were undertaken in the Burn of Muchalls.

40.2.21 Survey methods have been shown to yield largely similar levels of detail, demonstrating that despite small differences between survey protocols, results are comparable between the northern and southern sections of the proposed scheme.

Terrestrial Habitats

40.2.22 Habitats were assessed, coded and mapped using the survey methods outlined in the 'Handbook for Phase 1 Habitat Survey – a technique for environmental audit' (JNCC, 1993). A Phase 1 Habitat Survey of a 1km wide study corridor, centred on the proposed route alignment, was undertaken following guidance contained within the DMRB (2001). Areas of particular botanical interest were further surveyed using the National Vegetation Classification (NVC) following standard methods (Rodwell, 1991a, 1991b; 1992; 1995; 2000).

40.2.23 The survey was undertaken from May to July 2006, which is an optimal time of year to carry out botanical habitat surveys as flowering plants are in leaf and flower and the risk of misidentification is minimised. However, no survey of wildlife can guarantee that all biological cues are recorded, and early or late flowering species may be under represented.

40.2.24 To aid the interpretation of the habitat assessment for the Fastlink, its component route sections were sub-divided into Habitat Areas. These divisions were defined *a posteriori*, following analysis of the Phase 1 Habitat Survey data and the aerial photographs, forming the basis for the ecological evaluation of the habitats based on the features present and their location within the study corridor (Figures 40.3a-h). Several Habitat Areas may occur in each section of the route (e.g. a network of agricultural fields and areas of woodland). It is intended that these Habitat Areas provide a framework for discussion of key species occurring in each area.

Badger

40.2.25 The status of badger populations was assessed within a 1km route corridor centred on the proposed route alignment. The route corridor was surveyed for signs of badgers between 13 February and 6 July 2006, following methods by Harris et al. (1989) and the DMRB (Highways Agency, 2005) guidance. Where survey results indicated that further information was required from outside the route corridor, this boundary was increased. For example, where survey results suggested that a main sett was located just outside the route corridor and locating this sett would provide useful information regarding the local distribution of social groups, the survey corridor was extended ensuring that territories of all potentially impacted badger social groups were correctly identified.

40.2.26 Signs of badger activity were mapped with reference to data from the Phase 1 Habitat Survey (Appendix 40.1) to provide information about badger social group territories. Field signs included badger setts, badger paths, latrine sites, evidence of foraging and dung pits and can be summarised as follows:

- all hedgerows, dry stone walls, paths and other linear features, within the survey corridor, were walked to locate badger field signs. In addition, all areas of woodland and scrub were actively searched (where practicable);
- badger paths were identified through the observation of field signs including prints, badger hairs on barbed wire or vegetation, and dung pits; and
- the interiors of fields were surveyed in addition to their boundaries, where they exhibited evidence of badger foraging or where badger paths passed through them.

40.2.27 Significant delays were encountered with regards to obtaining land access, resulting in some areas not being surveyed until the late spring/summer. The consequences of surveys being delayed until later in the year have been discussed previously.

Bats

40.2.28 The aims of the bat surveys were to identify roosts, commuting routes and foraging areas using a combination of habitat assessment and bat activity surveys. The habitat assessment was undertaken to identify potentially important areas for bats, followed by surveys of key areas to assess the level of bat activity.

40.2.29 The study area was defined with regard to specified standards (DMRB, 2001) and consideration was given to the six species likely to be present (Ms Isobel Davidson, Aberdeen Bat Group pers.comm.; Richardson, 2000). The survey area extended 500m either side of the centreline of the proposed alignment, giving a 1km wide survey corridor. Although this is narrower than the ideal width for such surveys (DMRB, 2001), the survey area and methods were agreed with SNH (Jacobs Ecological Scoping Report, 2006) and preliminary surveys and desk study including information requests extended beyond 500m.

40.2.30 The habitat assessment was undertaken in spring/summer 2006, to identify potential roosts within natural and/or man-made structures (excluding mines) and to inform the scope of the bat activity surveys. The habitat assessment followed methods outlined by Walsh and Harris (1996a, 1996b), Entwistle et al. (1997), Jenkins et al. (1998), DMRB (2001) and Mitchell-Jones (2004).

40.2.31 Emergence surveys of roosts/potential roosts and activity surveys of habitats identified during the habitat assessment were undertaken at the optimal time between June and early August 2006 at select periods of dusk, dark and dawn following methods outlined by DMRB (2001) and Mitchell-Jones (2004). Surveys were carried out by suitably trained, experienced and licensed bat specialists as detailed in Table 40.1.

40.2.32 Methods were refined based on feedback from SNH and experiences encountered during the 2004 survey for the Northern Leg section. In consultation with SNH, it was agreed that further investigations into potential fragmentation and severance issues involving bats be undertaken and as such commuting route surveys were included as part of the ongoing bat activity surveys. Some of the surveys were completed in 2006 with the remainder to be completed in 2007.

40.2.33 Due to difficulties in obtaining access permissions and the resulting impact on available time to complete the surveys, activity surveys and buildings (i.e. potential roost sites) within 200m of the road alignment were prioritised. Surveys of buildings outside the 200m and commuting route surveys are being completed during the 2007 survey season.

Breeding Birds

40.2.34 A two-stage survey strategy (agreed with SNH, refer to Jacobs Ecological Scoping Report, 2006) was developed to select bird survey areas within a 1km wide study area (500m either side of the centreline of the proposed route). The first stage in the selection process involved the identification and selection of high value habitats referred to as Sites of Ornithological Value (SOV). These were identified by experienced ornithologists, based on an initial walkover survey together with an assessment of data supplied by the NESBReC and analysis of aerial photographs and Ordnance Survey maps.

40.2.35 The second stage in the selection process involved the use of a Line Transect and Quadrat sampling system to obtain a representative sample of remaining habitats outside of the SOVs. This was used to infer the importance of all remaining non-surveyed areas throughout the route corridor for breeding birds. A single, 500m wide transect was established along the centre of the study area along which 500m square Quadrats were systematically arranged and sampled at a ratio of 1:3.

40.2.36 Selected SOVs and Quadrats were subject to an adapted breeding bird survey (BBS) (based on the Common Bird Census (CBC) standard mapping technique as developed by the British Trust for Ornithology (Bibby et al., 2000). Observations of key species present within or adjacent to each of the SOV and Quadrat, in addition to the wider study area, were noted during the other ecological surveys for the proposed scheme.

40.2.37 The ecological value of each SOV, Quadrat and Habitat Area for breeding birds was determined by professional judgment. The ecological value of each SOV and Quadrat for breeding birds was determined by considering the evaluation of its habitat potential for breeding birds (derived from information in the Terrestrial Habitat report (Appendix A40.1) combined with the value of the breeding bird assemblage present.

40.2.38 An assessment was then made as to how representative the habitats found in each Quadrat or SOV were of the adjacent, non-surveyed areas. The ecological value of the remaining Ecological Habitat Areas in each route section was then determined, by an initial evaluation of their habitat potential for breeding birds combined with the knowledge of the breeding bird assemblages found in adjacent representative Quadrats or SOVs.

40.2.39 An update of the breeding bird survey will be included in an Environmental Report to be published later in 2007 following completion of repeat breeding bird surveys and subsequesnt re-analysis of the survey data. This is required due to incomplete baseline data in 2006 resulting from access difficulties.

Otter

40.2.40 The otter (*Lutra lutra*) survey was undertaken to identify holts, couches, other lying up areas, commuting routes and foraging areas within the study area. A survey of otter activity in a 1km wide study corridor (500m either side of the centreline of the proposed route) was extended where signs were not initially identified within the 1km study corridor, undertaken between March and July 2006, following methods outlined by Kruuk (1986) and DMRB (2001). As otters have no fixed breeding season, this period is considered to be optimal for identifying the features of importance to otters. This survey concentrated on, but was not exclusive to, watercourses and wetlands.

40.2.41 As otters avoid disturbance and are largely nocturnal, surveys are generally carried out by searching for otter field signs. In the present study, all watercourses and waterbodies including lochs, burns, rivers, field drains and ditches within the 1km route corridor (Figures 40.7a-h) were surveyed for signs indicative of the presence of otters, including:

- otter spraint;
- footprints;
- actual or potential resting sites. These include underground 'holts' (e.g. beneath the roots of bankside trees) or above ground 'couches' (e.g. in reedbeds);
- slides or other well-used access points to watercourses (though additional evidence would be required to positively confirm their use by otters);
- feeding remains, e.g. fish carcasses (though additional evidence would be required to positively confirm these as evidence of otter presence); and/or
- sightings, including otter Road Traffic Accidents (RTAs) and anecdotal evidence supplied by landowners.

40.2.42 In general, otter surveys only attempted to identify the terrestrial habitats of otters lying within 10m of a watercourse. In some areas where otter signs were abundant, the survey was extended to include adjacent habitats and to identify tracks leading from the watercourse. Incidental observations of tracks and signs were also made throughout the survey period.

Red Squirrel

40.2.43 Red squirrel (*Sciurus vulgaris*) surveys were conducted to determine the presence or absence of red squirrels and to identify areas of woodland supporting red squirrels. Due to the extent of the study area, and methodological difficulties in accurately assessing red squirrel population size, it was agreed with SNH that no attempt would be made to quantify levels of use of various habitats by this species. To determine the presence/absence of red squirrels, visual surveys and hair-tube surveys were undertaken in woodlands previously determined by walkover surveys as providing suitable red squirrel habitat within the 1km wide study corridor (500m either side of the centreline of the proposed route). The surveys were performed between May and July 2006, following methods outlined by Gurnell et al. (2001).

40.2.44 Hair-tube surveys collect squirrel hair on a sticky medium as they pass through baited tubes. Squirrel hairs collected were stained and viewed under a high-powered microscope to distinguish red or grey squirrel hairs, following methods outlined by Teerink (1991), Gurnell and Pepper (1994), and Dagnall et al. (1995).

Water Vole

40.2.45 Water vole (*Arvicola terrestris*) survey methods followed those described in the Water Vole Conservation Handbook (Strachan, 1998). All riparian zones, watercourses and standing water bodies within 250m either side of the centreline of the proposed alignment were surveyed for evidence of water vole occupation. All waterbodies were identified from Ordnance Survey maps, aerial photographs and through a preliminary walkover survey.

40.2.46 Water vole surveys were conducted in May, July and August 2006. All watercourses and ponds were surveyed from within the channel/pond, where possible, to give the best view of bank habitat. The survey comprised searching for field signs as described in Strachan (1998), which included burrows, latrines, footprints and feeding stations.

40.2.47 The habitat suitability of waterbodies for water voles was assessed using landscape factors known to be conducive to supporting water vole colonies (Strachan, 1998; Woodroffe, 2000).

Water Shrew

40.2.48 Water shrews (*Neomys fodiens*) are semi-aquatic and live along the banks of watercourses that are clean, clear and have a high number of invertebrates on which they feed. Water shrew are sometimes found far from water in woodlands or rough grassland (Churchfield, 1984). However, it has been suggested that such populations are only transitory, either in search of alternative food sources or using these terrestrial habitats to disperse from their natal ranges (Harris et al., 1995). Therefore, the habitat assessment focussed on the aquatic habitat and the immediate bank side vegetation.

40.2.49 Incidental sightings of water shrews were noted as part of the other ecological surveys undertaken between March and August 2006. Ordnance Survey maps (1:25000), aerial photographs, Phase 1 Habitat Survey target notes (Appendix 40.1) and the Freshwater Ecology Survey Report (Appendix A40.9) were used to identify waterbodies and areas showing the potential to support water shrew populations within the route corridor (500m either side of the alignment).

40.2.50 A desk-based survey was used to identify areas of terrestrial and aquatic habitat suitable for water shrews and their presence was assumed in all such areas. This habitat assessment was mainly based on the vegetation suitability and macroinvertebrate data taken from the Freshwater Ecology Report (Appendix A40.9) and Water Vole Report (Appendix A40.7). The desk survey, coupled with incidental sightings, was deemed sufficient to accurately reflect the ecological value of the water shrew presence and their habitat in this section.

40.2.51 Vegetation was assessed for suitability by examining the potential cover it offered to foraging water shrew. Water shrew habitat designations are awarded as follows in Table 40.2.

Table 40.2 – Water Shrew Habitat Quality

Habitat Value	Criteria
High	Suitable vegetation offering dense cover (i.e. abundant emergent vegetation, tall herbs etc.), with either water of Good or Excellent Quality or high Average Score per Taxon (ASPT scores).
Medium	Some suitable vegetation, with either Average water quality or medium ASPT scores.
Low	Poor quality or inappropriate vegetation with Low water quality and low ASPT scores.

40.2.52 In addition to assessing individual waterbodies, the network of watercourses was evaluated using professional judgement, taking into account the quality of each watercourse for water shrew and the connectivity, size and distribution of the network throughout the wider landscape.

Amphibians

40.2.53 Incidental sightings of amphibian species were noted as part of the other ecological surveys that were undertaken between March and August 2006. Ordnance Survey maps (1:25000), aerial photographs and Phase 1 Habitat Survey target notes were used to identify waterbodies and areas showing the potential to support amphibian populations within the survey route corridor (500m either side of the centreline of the proposed alignment).

40.2.54 Although common frog, common toad and palmate newt were recorded in the Northern Leg study area previously, no fully protected statutory species such as the great crested newt were recorded. A desk-based survey was used to identify areas of terrestrial and aquatic habitat within the study area that were suitable for amphibians. This desk survey coupled with incidental sightings was considered sufficient to accurately reflect the ecological value of the amphibians and their habitat in this section.

40.2.55 The quality of aquatic habitat was assessed for its suitability to hold breeding amphibians, using parameters identified by Oldham et al. (2000) that are of particular value to this stage in their life-cycle. These include the amount and type of water vegetation, the level of shading and presence of wildfowl. The proximity of other waterbodies was also taken into account, as neighbouring suitable waterbodies can increase the quality of the site. Aquatic habitat quality was rated following the criteria detailed in Table 40.3.

Table 40.3 – Evaluation of Aquatic Habitat Quality

Rating	Criteria
High	Lack of fish or waterfowl with aquatic vegetation, clear water, areas of shading and/or areas of shallow and deep water and/or within 300m of a waterbody suitable for amphibians.
Moderate	Occasional aquatic vegetation or dominated by *Glyceria fluitans* and a lack of shading. Less than 50% shading and no waterbody within 300m suitable for amphibians and/or a low population of fish or waterfowl. In late successional stage.
Low	A high fish, wildfowl or black headed gull population. Very turbid water, with no aquatic vegetation. Above 75% shading.

40.2.56 As no specific field surveys took place for amphibians, the quality of aquatic habitat in all waterbodies identified was assumed to be high enough to support breeding populations.

40.2.57 The terrestrial habitat was assessed as being suitable or not by using key parameters identified by Oldham et al. (2000) that indicate habitat of particular value, as well as considering the dispersion of habitats throughout the local landscape and the presence of any barriers to amphibian migration throughout the landscape. Favourable terrestrial habitat for amphibians would provide places for refuge, hibernacula and foraging opportunities. The rating of suitability of sites according to the criteria identified in Table 40.4 was conducted using key parameters identified by Oldham et al. (2000) that indicate habitat of particular value, as well as considering the dispersion of habitats throughout the local landscape and the presence of any barriers to amphibian migration throughout the landscape. Favourable terrestrial habitat for amphibians would provide places for refuge, hibernacula and foraging opportunities.

Table 40.4 – Evaluation of Terrestrial Habitat Quality

Rating	Criteria
High/Moderate (Suitable Habitat Features)	Presence of substantial woodland and/or large areas of scrub or rank grassland or large rock piles or many stone walls. Presence of a large area scrub and/or small spinney/copse or areas of rank grassland or rock piles or dry stone walls.
Low (Unsuitable Habitat Features)	Lack of woodland, scrub, rank grassland and rock piles.

Brown Hare

40.2.58 Brown hare (*Lepus europaeus*) presence within a 500m study corridor was assessed through the collation of incidental records made during all other floral/faunal surveys over a 15-week period, from May to August 2006. Data relating to the size and types of habitat within the study area were determined through review of the Phase 1 Habitat maps, to enable a general assessment of the suitability of the study area for brown hares.

Reptiles

40.2.59 The common lizard (*Lacerta vivipara*), slow-worm (*Anguis fragilis*) and adder (*Viperta berus*) are the only reptile species recorded as being present in the Aberdeen area (Arnold, 1995). Incidental sightings of reptile species were noted as part of the other ecological surveys undertaken between March and August 2006.

40.2.60 A desk-based survey was used to identify areas of habitat suitable for reptiles and their presence assumed in all such areas. Ordnance Survey maps (1:25000), high-resolution aerial photographs and data collected for the Phase 1 Habitat Survey were used to identify potential reptile habitat within the route corridor (500m either side of the centreline of the proposed alignment). Potential habitats include such areas as heathland, gorse scrub (*Ulex europaeus*), rough grassland, rank grassland, woodland edges, glades and rides. Other features include hedgerows and dry stone walls.

40.2.61 This desk survey coupled with incidental sightings was considered sufficient to accurately reflect the ecological value of the reptiles and their habitat in this section. A precautionary approach evaluation was adopted by assuming that any habitat capable of supporting a reptile population does so.

Terrestrial Invertebrates

40.2.62 Due to the large numbers of individuals and species of this taxon present in the study corridor, systematic surveying for terrestrial invertebrates was not considered practical. Instead, the assessment of potential impacts on terrestrial invertebrates was based on the habitat potential of sites to support terrestrial invertebrates throughout the proposed route corridor. The assessment focussed on habitats suitable for important species, including those identified in the NES LBAP (North East Biodiversity Audit, 1998).

40.2.63 Phase 1 Habitat Survey maps and target notes (Appendix A40.1: Terrestrial Habitats) were used to assess nature conservation potential of sites for invertebrates.

Freshwater Macroinvertebrates and Aquatic Habitats

40.2.64 A freshwater survey was undertaken to assess the general aquatic ecological health of watercourses potentially affected by the proposed scheme. Physical parameters such as discharge and the size of catchment area were used to enable efficient targeting of sampling effort and assist in the interpretation of survey data.

40.2.65 Watercourses were sampled for simple *in-situ* physico-chemical parameters and aquatic macro-invertebrates, following standard methods outlined by Wright et al. (1984). These samples were preserved and identified to species level, where possible, using published keys. Diversity indices including Biological Monitoring Working Party (BMWP) (ISO-BMWP, 1979) and Average Score Per Taxon (ASPT) values were calculated to provide a measure of the ecological status of each watercourse.

40.2.66 An accredited surveyor undertook River Habitat Surveys (RHS) in accordance with Environment Agency (EA) (2003) guidelines in summer 2006. RHS data were used to calculate a Habitat Modification Score (HMS). The assessment of the nature conservation value of each watercourse was based on water quality, macro-invertebrate community and habitat modification. An RHS was not undertaken for watercourses that were modified to the extent that they were considered by default to be severely modified.

40.2.67 During an initial RHS, the Burn of Muchalls was identified as a watercourse with potential suitable habitat for freshwater pearl mussels. However, following targeted surveys for freshwater pearl mussels, none were identified. The methods for freshwater pearl mussel surveys are provided in Appendix A25.10.

Fish

40.2.68 An initial walkover survey and habitat assessment of watercourses crossed by the proposed scheme was undertaken in May 2006. These initial watercourse surveys were to determine their potential to support fish, particularly salmonids. During the surveys, *in-situ* water quality measurements were also taken. Notes were made at each site describing the nature of the in-channel and riparian habitat, and in particular any factors likely to influence resident fish populations. These data were used to undertake a HABSCORE assessment, which is a predictive tool to provide an indication of fish likely to be present based on habitats present (Appendix 40.9: Freshwater Ecology).

40.2.69 Based on this assessment, watercourses suitable for electric fishing were identified and were surveyed in September 2006. Electric fishing was aimed at providing data on what species were present in each watercourse. A further survey was completed during January 2007 during which salmon spawning habitat was identified and evaluated through the identification of salmon redds.

40.2.70 Data from the macroinvertebrate and RHS were used to augment data from these walkover surveys. Using these data and professional judgment, the fish species most likely to be present in the watercourse were identified.

Wintering Birds

40.2.71 A two-stage survey strategy to select bird survey areas within a 1km wide study area was developed and agreed with SNH. The first stage of the selection of survey areas involved the identification and selection of waterbodies that are of high value to wintering geese, waders and wildfowl (referred to as Waterbodies of Ornithological Value (WOVs)). These were identified by experienced ornithologists based on an initial walkover survey together with an assessment of data supplied by the NESBReC and analysis of aerial photographs and Ordnance Survey maps. Consultation responses and preliminary survey work did not identify any WOVs within or adjacent to the study area for the Fastlink.

40.2.72 The second stage in the selection process involved the use of a Line Transect and Quadrat sampling system to obtain a representative sample of the habitats outside of the WOVs. This was used to infer the importance of all remaining non-surveyed areas throughout the route corridor for wintering birds. A single, 500m wide transect was established along the centre of the study area along which eight 500m square Quadrats were systematically arranged and sampled at a ratio of 1:3.

40.2.73 Selected Quadrats were subject to an adapted wintering bird survey (WBS) based on the Common Bird Census (CBC) standard mapping technique, as developed by the British Trust for Ornithology (Bibby et al., 2000). Observations of key species present within or adjacent to each Quadrat, in addition to the wider study area, were noted during other ecological surveys that were carried out.

40.2.74 Information obtained from the Phase 1 Habitat Survey (refer to Appendix A40.1) was used to inform a description of the habitats represented within each Quadrat and to assess the value of their habitats for wintering birds. A habitat value (expressed as high, medium or low) was assigned to each Quadrat and Ecological Habitat Area. In addition, data from the Quadrats were considered in the context of the Phase 1 Habitat Survey of the route corridor to determine how representative each Quadrat was of surrounding Habitat Areas. The values assigned to Habitat Areas were based upon a combination of their habitat evaluation and the results of the species surveys.

Assessment of Ecology and Nature Conservation Value (Baseline Evaluation)

40.2.75 The method for assessing the value of an ecological receptor uses all of the information collated in determining the baseline status of the resource. The ecological evaluation of a receptor is determined by reference to any designations, the results of consultations, a literature review and field surveys. The evaluation method incorporates a geographical framework where ecological receptors are assessed according to a series of criteria that are presented in Table 40.5. These criteria are based on the Ratcliffe Criteria (Ratcliffe, 1977) used in the selection of biological Sites of Special Scientific Interest (SSSI) and include size (extent), naturalness, rarity, typicality, vulnerability and position in an ecological/geographical unit.

40.2.76 The criteria used in the ecological evaluation process include reference to the legal protection conferred on species or habitats, such as presence on UK BAP or L BAP, as well as the conservation status of the receptor. These factors give rise to a level of conservation importance being assigned to species/habitats that reflects the geographical framework used in the evaluation process. Species such as otters and bats, which are protected by international legislation, are referred to as internationally important in terms of their conservation status. Other species such as wych elm, which are identified as priority species in the NES LBAP are referred to as regionally important species.

40.2.77 The ecological evaluation of a feature or area of habitat takes into account the level of conservation importance of the species, as well as other factors such as the level of use of the habitat or feature by a species, whether the species or habitat is locally or regionally common or rare, as well as other criteria that contribute to a feature's importance. In this way, the method of evaluation provides a system that combines legislative protection on species and/or habitats and conservation parameters that all contribute to the ecological importance of the receptor.

40.2.78 Terrestrial Habitat Areas (Appendix 40.1) and Freshwater Habitat Areas (Appendix 40.9) were used to provide a spatial framework for the assessments. In each Habitat Area, records of the species and the habitats or features used by individual species were considered, to provide an overall assessment of ecological value. For all habitats, and for species with home ranges that correspond with the Habitat Areas, an ecological evaluation was made per. Habitat Area. For species where home ranges cover larger areas than the Habitat Areas (e.g. badgers and otters), the ecological evaluation represents a spatial resolution appropriate to these species.

40.2.79 The status of bird species was also used to assist in their evaluation. The Joint Nature Conservation Committee (JNCC) categorises 247 species in the UK as either Red listed (population in severe decline), Amber listed (populations in moderate decline or previously in severe decline but are recovering), or Green listed (no identified threat to their populations).

40.2.80 Evaluation criteria used to evaluate sensitivity/importance are provided in Table 40.5.

Table 40.5 – Evaluation of Ecological Receptor

Value/Importance	Criteria
International (European)	Habitats An internationally designated site or candidate site (Special Protection Area [SPA], provisional SPA [pSPA], Special Area of Conservation [SAC], candidate SAC [cSAC], Ramsar Site, Biogenetic/Biosphere Reserve, World Heritage Site) or an area that would meet the published selection criteria for designation. A viable area of a habitat type listed in Annex I of the Habitats Directive, or smaller areas of such habitat, which are essential to maintain the viability of a larger whole. Any river classified as Excellent A1 and likely to support a substantial salmonid population. Any river with a Habitat Modification Score indicating that it is Pristine or Semi-Natural or Obviously Modified. Species Any regularly occurring population of internationally important species, threatened or rare in the UK. (i.e. a UK Red Data Book species categories 1and 2 of UK BAP) or of uncertain conservation status or of global conservation concern in the UK BAP. A regularly occurring, nationally significant population/number of an internationally important species.
National (Scottish)	Habitats A nationally designated site (Site of Special Scientific Interest [SSSI], Area of Special Scientific Interest [ASSI], National Nature Reserve [NNR], Marine Nature Reserve [MNR]) or a discrete area which would meet the published selection criteria for national designation (e.g. SSSI selection guidelines). A viable area of a priority habitat identified in the UK Biodiversity Action Plan (BAP), or of smaller areas of such habitat essential to maintain wider viability. Any river classified as Excellent A1 and likely to support a substantial salmonid population. Any river with a Habitat Modification Score indicating that it is Pristine or Semi-Natural or Obviously Modified. Species A regularly occurring, regionally or county significant population/number of an internationally/nationally important species. Any regularly occurring population of a nationally important species, which is threatened or rare in the region or county (see local BAP). A feature identified as of critical importance in the UK BAP.
Regional (North East Scotland)	Habitats Sites that exceed the County-level designations, but fall short of SSSI selection criteria. Viable areas of key habitat identified in the Regional BAP or smaller areas of habitat essential to maintain wider viability. Viable areas of key habitat identified as of Regional value in the appropriate Scottish Natural Heritage (SNH) Natural Heritage Future area profile. Any river classified as Excellent A1 or Good A2 and capable of supporting salmonid population. Any river with a Habitat Modification Score indicating that it is Significantly Modified or above. Species Any regularly occurring, locally significant population of a species listed as being nationally scarce which occurs in 16 of 100 10km^2 squares in the UK or in a Regional BAP or relevant SNH Natural Heritage Future area on account of its regional rarity or localisation. A regularly occurring, locally significant population/number of a regionally important species. Sites maintaining populations of internationally/nationally important species that are not threatened or rare in the region or county.
Authority Area (e.g. County or District) Aberdeenshire/City of Aberdeen	Habitats Sites recognised by local authorities, e.g. District Wildlife Sites (DWS) and Sites of Interest for Nature Conservation (SINS). County/District sites that the designating authority has determined meet the published ecological selection criteria for designation, including Local Nature Reserves (LNR). A viable area of habitat identified in County/District BAP or in the relevant SNH Natural Heritage Future area profile. A diverse and/or ecologically valuable hedgerow network. Semi-natural ancient woodland greater than 0.25 ha. Any river classified as Good A2 or Fair B and likely to support coarse fishery. Any river with a Habitat Modification Score indicating that it is Significantly Modified or above. Species Any regularly occurring, locally significant population of a species listed in a County/District BAP due to regional rarity or localisation. A regularly occurring, locally significant population of a County/District important species. Sites supporting populations of internationally/nationally/ regionally important species that are not threatened or rare in the region or county, and not integral to maintaining those populations. Sites/features scarce in the County/District or which appreciably enrich the County/District habitat resource.

Value/Importance	Criteria
Local (immediate local area or village importance)	Habitats Areas of habitat that appreciably enrich the local habitat resource (e.g. species-rich hedgerows, ponds). Sites that retain other elements of semi-natural vegetation that due to their size, quality or the wide distribution within the local area are not considered for the above classifications. Semi-natural ancient woodland smaller than 0.25ha. Any river classified as Fair B or Poor C and unlikely to support coarse fishery. River with a Habitat Modification Score indicating that it is Severely Modified or above. Species Populations/assemblages of species that appreciably enrich the biodiversity resource within the local context. Sites supporting populations of county/district important species that are not threatened or rare in the region or county, and are not integral to maintaining those populations.
Less than Local (limited ecological importance)	Sites that retain habitats and/or species of limited ecological importance due to their size, species composition or other factors. Any river classified as Impoverished D and/or with a Habitat Modification Score indicating that it is Severely Modified.

Impact Assessment

40.2.81 As described in Chapter 5 (Overview of Assessment Process), impact significance was determined with respect to the sensitivity/importance of the baseline conditions and the magnitude of potential impact. This is described in detail below.

Impact Magnitude

40.2.82 Methods of impact prediction used included direct measurements, correlations, expert opinion and information from previous developments. Impacts include those that are predicted to be direct, indirect, temporary, permanent, cumulative, reversible or irreversible. The magnitude of each impact was assessed independently of its value or statutory status.

40.2.83 Magnitude criteria are presented in Table 40.6 and include positive impact criteria in accordance with IEEM guidance (2002).

Table 40.6 – Impact Magnitude

Magnitude	Criteria
High negative	The change is likely to permanently, adversely affect the integrity of an ecological receptor, in terms of the coherence of its ecological structure and function, across its whole area that enables it to sustain the habitat, complex of habitats and/or the population levels of species of interest.
Medium negative	The change is not likely to permanently, adversely affect the integrity of an ecological receptor, but the effect is likely to be substantial in terms of its ecological structure and function and may be significant in terms of its ecological objectives. Likely to result in changes in the localised or temporary distribution of species assemblage or populations, but not affect the population status at a regional scale or permanently.
Low negative	The change may adversely affect the ecological receptor, but there will probably be no permanent effect on its integrity and/or key attributes and is unlikely to be significant in terms of its ecological objectives. Impacts are unlikely to result in changes to the species assemblage or populations, but core species more vulnerable to future impacts.
Negligible	The change may slightly adversely affect the receptor, but will have no permanent effect on the integrity of the receptor or its key attributes. There are no predicted measurable changes to the species assemblage or population and the effect is unlikely to result in an increased vulnerability of the receptor to future impacts.
Positive	The change is likely to benefit the ecological receptor, and/or enhance the biodiversity resource of the receptor.
High positive	The change is likely to restore an ecological receptor to favourable conservation status, contribute to meeting BAP objectives (local and national) and/or create a feature that is of recognisable value for biodiversity.

Impact Significance

40.2.84 The significance of impacts was then determined according to the matrix of value/sensitivity and magnitude as illustrated in Table 40.7.

Table 40.7 – Impact Significance

Value/Sensitivity	Magnitude					
	High Negative	**Medium Negative**	**Low Negative**	**Negligible**	**Positive**	**High Positive**
International	Major	Major	Moderate	Negligible	Moderate	Major
National	Major	Major	Moderate	Negligible	Moderate	Major
Regional	Major	Moderate	Minor	Negligible	Minor	Moderate
Authority Area	Moderate	Moderate	Minor	Negligible	Minor	Moderate
Local	Minor	Minor	Minor	Negligible	Minor	Minor
Less than Local	Minor	Negligible	Negligible	Negligible	Negligible	Negligible

Limitations to Assessment

40.2.85 Seasonal constraints and delays in agreeing access led to some areas not being completed for the following surveys:

- Bats (remaining: hibernacula, monitoring, emergence and activity surveys ongoing 2007); and
- Breeding Birds (remaining: completion of site survey in spring 2007).

40.2.86 Surveys are ongoing at the time of writing this report and the full results will be published in an Environmental Report later in 2007. Pending completion of these surveys, a provisional assessment on bats and breeding birds has been undertaken.

40.3 Baseline Conditions

40.3.1 Due to the complexity of assessing the wide range of species and habitats present, the description of baseline conditions in this section is reported separately to their evaluation, which is described in section 40.4. Further information on habitats and species in the study area is provided in the Appendices, A40.1 to A40.9.

Terrestrial Habitats

Consultation and Literature Review

40.3.2 SNH provided records of ancient and long-established woodlands from their Semi-natural and Ancient Woodland Inventories, and peatlands listed in the Lowland Raised Bog Inventory (LRBI).

40.3.3 Aberdeen City Council provided details of statutory and non-statutory designated sites of ecological importance including Special Sites of Scientific Interest (SSSI), District Wildlife Sites (DWS) and a list of North East of Scotland Local Biodiversity Action Plan (NES LBAP) priority habitats. The NES LBAP Coordinator confirmed locally important species and priority habitats.

40.3.4 The North East Scotland Biological Records Centre (NESBReC) provided Phase 1 Habitat Survey results undertaken by the Scottish Wildlife Trust (1992 to 1997 and 2002), a plan showing DWS and the results of the Grampian Natural Habitat Survey (1988).

40.3.5 The Forestry Commission provided data about forest/woodland areas and their management.

Designated Areas

40.3.6 There are no internationally, nationally or locally designated areas of conservation concern within the study area. The internationally important Red Moss of Netherley SAC lies approximately 1km to the west of the proposed scheme.

40.3.7 Limpet Wood, Megray Wood and Slicewells Wood are listed in the Ancient Woodland Inventory as being of long-established origin (Figures 40.1a-h).

40.3.8 Habitat types in the study area include boundary and linear features, arable and horticultural land, improved grassland, fen, marsh and swamp, coniferous woodland and broadleaved, mixed (and yew (*Taxus baccata*) woodlands.

40.3.9 Several priority UK BAP habitats are present in the study area, including lowland heath, lowland raised bog, cereal field margins, lowland meadows, wood-pasture and parkland, and wet woodland. The NES Biodiversity Audit identified that Aberdeenshire holds 44 listed habitats. The habitats are well represented in NE Scotland in a UK or Scottish context. Those of relevance to the study area are planted coniferous woodlands, acid grassland, lowland raised bogs and fens. In addition, six locally important habitats were identified. Of these, four are relevant to the study area: scrub, riparian woodland, birch woodlands and serpentine grassland/heath mosaic. Birch (*Betula* sp.) woodlands and serpentine grassland/heath mosaic are considered to be of national significance.

40.3.10 The NES Biodiversity Audit identified approximately 309 listed species in Aberdeenshire. UKBAP and NES LBAP Priority species include the red squirrel, otter, freshwater pearl mussel (*Margaritifera margaritifera*), river and brook lamprey (*Lampetra fluviatillis* and *L. planeri*) and water vole. Several bird species also are national and local prioirity species, including the bullfinch (*Pyrrhula pyrrhula*), linnet (*Perdix perdix*), song thrush (*Turdus philomelos*), and skylark (*Alauda arvensis*). An NES LBAP stonefly (*Brachyptera putata*) was also recorded by SEPA during routine monitoring of the River Don between 1980 and 2003.

40.3.11 Additional NES LBAP Priority and locally important species include Daubenton's bat (*Myotis daubentonii*), wych elm (*Ulmus glabra*), kingfisher (*Alcedo atthis*), goldeneye (*Bucephala clangula*), and yellowhammer (*Emberiza citronella*).

Field Survey

40.3.12 The results of the Phase 1 Habitat survey and target note numbers are presented in Figures 40.2a-g and are detailed in Appendix A40.1. On the basis of these results, further boundaries were drawn to form Phase 1 Habitat Areas, to delineate an obvious ecological unit. Results have been described using these Habitat Areas, which are referred to as F1 to F27.

40.3.13 The following paragraphs briefly describe the main habitats found in the study area, with Habitat Area numbers given in parentheses, a summary of which is presented in Table 40.8. The description is from south to north following the route corridor and reported in the route sections for clarity.

Section FL1

40.3.14 Arable fields dominant the landscape within this section. Some fields in the east contain a diverse ground flora of arable weeds (F3), whilst fields to the west are shielded by a semi-natural shelterbelt (F2). Shrubs are no more than occasional across the fields as a whole. A small plantation is located at H Ram Wood (F4).

40.3.15 Megray Wood (F6) and Limpet Burn Wood (F7) are two connected but very different woodlands. Megray Wood is a conifer plantation dominated by Scots pine (*Pinus sylvestris*) and Sitka spruce (*Picea sitchensis*), although there are small patches of wet woodland surrounding Megray Burn where HAs F6 and F7 meet.

40.3.16 Limpet Wood (F7), which is on the Ancient Woodland Inventory (AWI), is comprised of a mosaic of habitats including woodland and marshy grassland. There is mature mixed plantation woodland on the top of the slope and at the bottom of the slope grading into semi-natural wet woodland dominated by willow (*Salix* sp.) and birch with marshy grassland, further west this grades into dense gorse scrub and mesotrophic semi-improved grassland.

40.3.17 Slicewells Wood (F5), which is on the AWI, Fishermyre Wood and its surrounds (F10, F11 and F12) are composed of a number of wet habitats. Semi-natural broad-leaved woodland, co-dominated by birch and rowan (*Sorbus aucuparia*), is present in Slicewells Wood and the wet woodland in Fishermyre Wood South near Coneyhatch Farm (F10). Fishermyre Wood South is co-dominated by birch and goat willow (*Salix caprea*) with areas of marsh and fen with acid grassland in drier areas.

40.3.18 West Fishermyre Wood (F11) is dominated by wet woodland, although this gives way to conifer plantation and acid grassland to the west.

40.3.19 Fishermyre wetland to the north (F12) and west (F11) are drier in character with areas of semi-improved acid grassland, dry heath and gorse scrub throughout. Dry heath is the most abundant habitat in these areas, being overtaken by fen in the wetter areas. Within the centre and south of the wetland, a willow carr is succeeding. The east and north is characterised by dense gorse scrub and semi-natural mixed woodland.

40.3.20 Green Burn supports fen and wet woodland, as well as a species-poor marsh.

Section FL2

40.3.21 This section is dominated by improved and arable fields, most of which are bordered by dry stone walls, with occasional gorse hedges. There are a very few newly planted broad-leaved hedges, occasional mature beech and Scots pine shelter belts, and rare riparian woodland.

40.3.22 Habitat including and surrounding the Burn of Muchalls (F13, F15 and F16), is diverse in terms of composition. A number of young newly planted hedgerows (approximately two to five years old) that have been fenced off are located in this section. These are comprised of traditional, largely broad-leaved hedgerow species such as hawthorn (*Crataegus monogyna*), beech (*Fagus sylvatica*), hazel (*Corylus avellana*) and sweet briar (*Rosa rubiginosa*) with occasional holly (*Ilex aquifolium*).

40.3.23 Several man-made ponds are present in the eastern section of F16, which supports a surrounding of willow scrub and marshy grassland. The ponds located in F15 are surrounded by marshy grassland and young mixed plantation woodland. The marshy grassland is comprised of frequent tufted hair grass (*Deschampsia caespitosa*) and Yorkshire fog (*Holcus lanatus*) and marsh thistle (*Cirsium palustre*) with occasional marsh marigold (*Caltha palustris*), wild angelica (*Angelica sylvestris*), marsh valerian (*Valeriana dioica*), meadowsweet (*Spiraea ulmaria*) and ground elder (*Aegopodium podagraria*). The mixed plantation woodland is comprised of alder (*Alnus glutinosa*), willow species, whitebeam (*Sorbus aria*), Scots pine, bird cherry (*Prunus padus*), wild cherry (*Prunus avium*), rowan and Norway spruce (*Picea abies*).

40.3.24 Areas of semi-natural wet woodlands adjacent to the riparian zone of the Burn of Muchalls comprise of rowan, alder and willow with several areas of young (approximately 20-30 years old) mixed plantation woodland.

40.3.25 Heathland habitats are present to the south of the Burn of Muchalls (F14).

Section FL3

40.3.26 Agricultural habitats dominate this section with dry stone walls, hedgerows and scrub forming the boundary of several fields. This section also contains a significant amount of wetland habitat.

40.3.27 Riparian habitat surrounding Cookney Ditch and Stoneyhill Burn form the limits of wet willow wood that supports species rich marshy grassland covered in goat willow and gorse scrub.

40.3.28 Stranog Burn, Cairns Burn, Crossley Burn and Whiteside Burn include a number of wet habitats that appeared to be hydrologically linked. An acid grassland/wet heath complex is present within the centre of the section (F23). This has been partly overlain by a new plantation in the north (F25), whilst in the east this grades into a bog community (F24). The bog becomes more modified farther east, due to laid tracks and planted trees. Towards the south, hydrological flow can be seen by the occurrence of marsh upon improved fields (F21). Upon levelling, the community succeeds to a dry heath/acid grassland complex.

40.3.29 The banks of Crynoch Burn (F27) are characterised by scattered willow and wet mesotrophic grassland communities in the floodplain. Although variable, the high moisture element is indicated by the presence of Yorkshire fog, rushes and tufted hair-grass. Other semi-improved grassland is of a more acidic nature and is present close to the wet habitats of bog and heath (F17, F23 and F25).

Table 40.8 – Terrestrial Habitat Descriptions

Habitat Area	Feature/Site	Phase 1 Description of Habitat Area
F1	Agricultural fields between the A90 and Stonehaven	Series of agricultural fields with scattered scrub. The Aberdeen-Stonehaven section of railway line contains semi-natural habitats and is part of a larger linear habitat.
F2	Agricultural fields west of New Mains of Ury	Extensive area of arable farmland, with shelterbelt woodlands
F3	Agricultural fields to the north of Megray Farm	Large arable fields with a small occasional scattered scrub and arable weed borders.
F4	H Ram Wood	Small pocket of mature LHAP plantation woodland.
F5	Fishermyre Wood	Viable area of semi-natural wet birch broad-leaved woodland listed in the AWI. Wet woodland is listed as a UKBAP and LBAP Priority Habitat. This area also connects to other wetland habitats, including fen (F12).
F6	Megray Wood	Mature conifer plantation (LHAP priority) with an LHAP small burn which supports and connects to viable area of more species-rich wet woodland (UKBAP priority habitat).
F7	Limpet Burn	Mosaic of semi-natural communities along heavily vegetated burn. Communities include a dense marsh with scattered willow carr, wet birch woodland (UKBAP priority habitat), dense bracken and continuous gorse scrub. Area included on the AWI.
F8	Agricultural fields surrounding Coneyhatch and Wyndford Farm	Series of arable and improved fields, with occasional marshy grassland and scattered scrub.
F9	Kempstone Hill	Dry heath/acid grassland mosaic with frequent gorse and willow scrub.
F10	Fishermyre Wood south	Wetland habitats, including BAP priority habitats of wet woodland and lowland heathland forms a part of the Fishermyre Wood wetland system
F11	Fishermyre Wood west.	Viable area of semi-natural wet birch woodland (UKBAP priority habitat) combined with dense continuous gorse scrub. Behind the birch wood is a Scots pine conifer plantation (LHAP priority), with acid grassland underneath and beyond. The hill to the north is composed of semi-improved neutral grassland.
F12	Fishermyre Wood. Wet habitats to the south of Allochie Croft	The majority of this area is dominated by dry heath (Lowland Heathland UKBAP). The south contains willow carr (UKBAP Wet Woodland) and Fen (UKBAP Fens).
F13	Agricultural fields surrounding Hill of Muchals	Extensive area of arable farmland with shelterbelt woodlands
F14	Heath by Allochie	Small area of LBAP heathland with ongoing process of grubbing up
F15	Burn of Muchalls	LHAP riparian habitat surrounding the Burn of Muchalls, including small and localised areas of semi-natural UKBAP wet woodland and young mixed plantation woodland.
F16	Agricultural fields from north of the Burn of Muchalls to Cookney	Agricultural land with many newly planted hedgerows and rows and groups of standards trees, plus mature Scots pine and beech lining and shelter belts.
F17	Wet habitats north of Cookney	Series of wetland habitats including UK BAP lowland bog and heathland.
F18	Agricultural fields from Cookney to East Rothnick Wood	Agricultural fields with scrub.
F19	Stoneyhill	Species-rich marshland with UK BAP willow carr developing.

Habitat Area	Feature/Site	Phase 1 Description of Habitat Area
F20	Agricultural fields around Berry Top	Series of agricultural fields with occasional pockets of scattered scrub.
F21	Wet habitats around East Crossley	The habitats grade from LHAP soft rush dominated fields to a more ecologically valuable dry heath (UK BAP Lowland Heathland)/acid grassland mosaic. Scrub is frequent.
F22	Agricultural fields from Quoscies to Stranog	Improved fields with soft rush and gorse scrub.
F23	Dry heath/acid grassland mosaic to the west of Wedderhill	Dry heath with wet heath characteristics (UK BAP Lowland Heathland)/acid grassland mosaic. Patches of wet heath leading onto bog are also present.
F24	Bog/heath to the immediate west of Wedderhill	Wet heavily modified bog with dry heath (UK BAP Lowland Heathland), UK BAP wet birch woods and scattered broadleaves and conifers, plus a small vegetated burn (Rivers and Burns LHAP) is present with a pool of standing water.
F25	Plantation woodland south of Stranog	Young plantation woodland underlain by dry heath/acid grassland mosaic.
F26	Agricultural fields to the south of Polston Farm	Dominated by improved fields with scrub and marsh.
F27	Floodplain and immediate surrounds of Crynoch Burn (south)	Mesotrophic semi-improved grassland (LHAP Species rich grassland) giving way to improved fields with abundant gorse scrub. Also contains Crynoch Burn – part of the River Dee SAC catchment.

Badger

40.3.30 Badgers (*Meles meles*) and their setts are legally protected by the Protection of Badgers Act (1992), the Nature Conservation (Scotland) Act (2004) and through inclusion in Schedule 6 of the Wildlife Countryside Act (1981). Through these Acts, badgers are legally protected from intentional or reckless cruelty, such as badger-baiting and from the results of lawful human activities, such as housing, road or other developments. Badgers are afforded protection from wilful or attempted killing, injuring and interference with a badger's sett.

Consultation and Literature Review

40.3.31 Badger sett and RTA locations within the study corridor were supplied by Grampian Badger Survey (Mr Mike Harris, Grampian Badger Survey, personal communication) and NESBReC. An independent report to Aberdeen City Council was also made available (Harris, 1997).

40.3.32 Where the study corridor crosses existing roads, for the period from 1999-2006, six badger RTAs were recorded on unclassified roads. Full details on the locations of these records are provided in Appendix A40.2.

40.3.33 Badger setts were located through a combination of consultation and survey. These locations have informed the subsequent impact assessment and have been provided as a confidential report to SNH, but due to risk of badger baiting and snaring, this information is not published within the ES.

Field Survey

40.3.34 A total of seven social groups were identified during the survey (these have been lettered A to G) with signs of an unidentified group being recorded to the northwest of Fishermyre Moss. Only three social groups were actually located inside the survey corridor, with the remaining social groups beyond the survey corridor likely to use the habitat within only occasionally. All main setts were found in woodland or gorse, with the exception of main sett D1, which was located in willow carr scrub. Some patches of gorse scrub were too dense to be surveyed and may have contained additional badger setts that have not been identified in this report.

Section FL1

40.3.35 The landscape is generally exposed, with limited good quality setting habitat due to few areas of woodland. There are extensive wet, boggy areas such as Fishermyre Moss as well as dry heathland in the form of Kempstone Hill. The small to medium sized areas of woodland present Slicewells, Megray Wood, Fishermyre Wood and Limpet Burn Wood comprise either dense coniferous plantations and/or have poorly drained soils resulting in poor sett building. Habitat Areas of gorse scrub are however abundant and do offer alternative setting habitat. Pasture fields are likely to be only moderately productive in terms of earthworms, given that soils may be thinner due to altitude and exposure to North Sea winds.

40.3.36 Two Social Groups A and B are using this section for foraging, although only one main sett is present within the route corridor, B1 (F7). Social Group A has one main sett and three outliers outside the study area to the west. Social Group B, in addition to the main sett social group, has three other outlier setts from Megray wood (F6) to Kempstone Hill (F8). This area offers setting and foraging habitat within Megray wood and in stubble fields to the east.

Section FL2

40.3.37 The habitats in this section are also characterised by a mosaic of pasture and arable fields, with patches of dense gorse. There are, however, no major areas of woodland and the pasture is likely to be only moderately productive.

40.3.38 There is only one Social Group (D) resident within this section with one main sett in F16 and two outliers (which may belong to Social Group E). Dense gorse beyond the boundary of the study area may support further setts for this Social Group. There is another Social Group (C) with a main sett to the east of the study area with two outlier setts that are likely to be foraging in the surrounding pasture and semi-improved grassland.

Section FL3

40.3.39 Moderate to large sized arable and pasture fields predominate, while East Crossley Wood represents the only area of woodland in this section. Gorse is however abundant, particularly in the vicinity of Stranog Hill, and represents alternative setting habitat and safe commuting. Pasture fields are likely to offer moderate numbers of earthworms.

40.3.40 Two Social Groups (F and G) have main setts outside the study areas, with one main sett of Social Group (E) within the study area at Stranog Hill (F22). Further setts may be present within dense gorse in Wedderhill to the east of the study area.

Bats

40.3.41 All British bat species and their roosts are protected under Annex IV of the Habitats Directive (transposed as Schedule 2 of the Conservation (Natural Habitats & c.) Regulations 1994) and Schedule 5 of the Wildlife and Countryside Act (1981) which is a ratification of the Bern Convention (1982) as amended by the Nature Conservation (Scotland) Act 2004. This affords bats protection against intentional or reckless killing, injuring or taking or damage, destruction or obstruction of roost sites. By law, a roost is any structure or place used for shelter or protection.

40.3.42 As bats tend to reuse the same roosts, the roost is protected whether the bats are present or not. Bats (with the exception of the common pipistrelle) are further protected through inclusion in Appendix II of the Bern Convention (1982) and the Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention, 1992). The Agreement on the Conservation of Bats in Europe (EUROBATS) came into force in 1994.

Consultation and Literature Review

40.3.43 Five bat species have been reported breeding in Aberdeenshire (Ms Isobel Davidson, University of Aberdeen, pers.comm.):

- Common pipistrelle bat (*Pipistrellus pipistrellus*);
- Soprano pipistrelle bat (*Pipistrellus pygmaeus*);
- Brown long-eared bat (*Plecotus auritus*);
- Daubenton's bat (*Myotis daubentonii*); and
- Natterer's bat (*Myotis nattereri*).

40.3.44 The NESBReC and the University of Aberdeen provided no recent data for the survey area, although Aberdeen University has published a number of scientific papers from the area (Rydell et al., 1994).

40.3.45 There have been isolated sightings of Nathusius' pipistrelle (*Pipistrellus nathusii*) near Aberdeen and Leisler's bats (*Nyctalus leisleri*) have been recorded foraging near Peterculter, although the population status of these species within Aberdeenshire is currently unclear (Mr Rob Raynor, SNH, pers.comm.).

Field Survey

40.3.46 The following provides a summary of baseline conditions with respect to bats in the vicinity of the proposed scheme, more details can be found in Appendix A40.3 (Bat Report).

40.3.47 Populations of bats are considered to be sparse in Aberdeen (Ms Geraldine McGowan, NES, pers. comm.). Therefore, any observation where two or more were observed at once is considered to represent a locally significant number of bats.

40.3.48 Bat numbers were variable along the route, reflecting the suitability of the habitat although activity was distributed relatively evenly between the three sections. Bat activity was observed to be greatest in woodland and burn habitats and in buildings such as Cookney Village. The bat survey results for Sections FL1 to FL3 are presented in Figures 40.4a-f.

40.3.49 Section FL1 is characterised by large open and exposed areas of farmland, with low inherent value to bats, along the southern and easternmost parts, while broad-leaved, mixed and conifer plantation woodland dominate the centre of the section. Linear features include a mature broadleaved shelterbelt, continuous woodland habitat along the western edge of the section (along the B979 road) and scrub lined tracks, field boundaries and riparian woodland along burns which connect potential roost sites and foraging areas both inside and outside the study area. Megray and Limpet Burns are also of value to foraging and commuting bats.

40.3.50 When recording bat passes, large numbers are uncertain due to the speed at which they pass. A total of at least 209 bat passes were recorded within this section from two species (common and soprano pipistrelle bats). Of these, approximately 158 were foraging bat passes centred along the shelterbelt beside the B979. The foraging passes where sighted around New Mains of Ury Farm and Steading, along Limpet Burn, around Megray Woods, beside the junction between Fishermyre Wood and the woodlands north of Fishermyre. Commuting routes were identified along Megray Burn, along the track between Megray Farm and Forester's Croft, in several places along the B979 where there is woodland adjacent to the road, along the edges and ride within Megray woods and along Limpet Burn. This section includes four identified roosts in farm buildings in one Habitat Area. Daytime surveys identified seven potential roosts in buildings and two culverts over Megray Burn were assessed as having roost potential. Potential tree roosts were identified within the shelterbelt along the B979, within the southern portion of Megray Woods and along the valley sides adjacent to Limpet Burn.

40.3.51 Section FL2 contains five Habitat Areas and is characterised by large areas of open farmland of limited foraging value to bats, with a network of field boundaries composed of stone dykes, drains and gorse- and tree-lined tracks, which provide some commuting potential. A large area of open heath in the southwest of the section has limited foraging value away from the scrub and mixed woodland edges due to high exposure levels. Burn and riparian habitats run across the width of the section connecting high value habitat and potential roosts. A total of at least 204 bat passes were recorded within this section from three species (common and soprano pipistrelle and Daubenton's bat). Of these passes, 135 were from foraging bats centred around the Burn of Muchalls, along the road and around buildings and gardens between Fishermyre and the Burn of Muchalls, along the track between Elrick and the Burn of Muchalls, and along the access track south of Cookney in association with the gardens. Commuting routes were identified along the edge of the woodland beside the B979, along the Burn of Muchalls, between Elrick and the Burn of Muchalls, along the drain to the north of Clayfolds and along the access track running south from Cookney.

40.3.52 Eight roosts, including a potential brown long-eared bat roost, were identified in buildings. A Daubenton's bat roost was identified in a culvert a short distance outside of the study area in this section. A further 11 buildings and one culvert were identified as having roost potential during day surveys. Four sites containing potential tree roosts were identified including several trees along the Burn of Muchalls.

40.3.53 Section FL3 is characterised by large areas of open farmland of limited foraging value to bats. A network of tracks, roads and field boundaries including stone dykes, gorse scrub and drains provide commuting potential. Small fragments of scattered gorse and willow scrub, coniferous plantation and heath provide medium to high foraging potential and good commuting potential along their edges. Crynoch Burn and associated riparian habitat provides an ideal corridor connecting valuable foraging and roosting habitat within and outside of the study area. A total of at least 202 bat passes was recorded within this section from common and soprano pipistrelles,

Daubenton's and Natterer's bats. Social calls were also recorded. Foraging activity was centred around Cookney, and Crynoch Burn, and was also recorded along a tree lined road between Burnhead and Craigentath, at Burnhead, Crossley and Altries Manse, and along several tree and scrub lined tracks throughout the section, often associated with buildings. Commuting routes were identified along the edge of the road to the south of Crossley and along Crynoch Burn. The road to the north of Altries Manse is also likely to be a commuting route.

40.3.54 Seven roosts were identified in buildings during daytime and evening surveys. A further 20 buildings were identified as potential roosts during day surveys. Two culverts were identified as having roost potential.

Breeding Birds

40.3.55 The Birds Directive (1979) provides full protection for all Annex I species and their habitats, listing species that may be conditionally hunted in Annex II and III. Under the Wildlife and Countryside Act (1981) (as amended) all wild birds, their nests and eggs are protected. However, game birds are not included in this definition (except for limited parts of the Act, Schedule 2) and are covered by the Game Acts, which confer protection during the closed season. Schedule 1 birds that may be present along the route include the fieldfare (*Turdus pilaris*), kingfisher (*Alcedo atthis*), barn owl (*Tyto alba*) and osprey (*Pandion haliaetus*).

Consultation and Literature Review

40.3.56 SNH did not provide any records of breeding birds in their consultation correspondence. Consultation with the Royal Society for the Protection of Birds (RSPB) confirmed that there are no RSPB nature reserves within or adjacent to the proposed scheme study area.

40.3.57 The Scottish Ornithologists' Club (SOC) and the RSPB are jointly involved in a five-year project to produce a Breeding Bird Atlas for Aberdeenshire. Records of confirmed, possible and probable breeding bird species were available for some areas within the route corridor. However, survey data were not obtained from SOC and the RSPB for the following reasons:

- the data were not of sufficient detail in terms of the location of bird species for an EIA (the survey resolution was too large); and
- data derived from SOC/RSPB and Jacobs surveys were incompatible due to data collation differences. SOC/RSPB used the Brown and Shepherd (1993) method for surveying upland breeding wader populations, but Jacobs surveyors used the CBC methodology.

Field Survey

40.3.58 Six SOVs were identified in the study area, within or adjacent to the proposed scheme corridor:

- Limpet Burn (F7);
- Kempstone Hill (F9);
- South Fishermyre (F10);
- North Fishermyre (F12);
- Harecraig (F19); and
- Cookney (F16).

40.3.59 These data are presented in (Figures 40.5a-f) and account for approximately 19% of the total study area.

40.3.60 Eight Quadrats were also surveyed:

- Quadrat FLQ1 Stonehaven (F1, F2 and F3);
- Quadrat FLQ2 Megray (F6, F7 and F8);

- Quadrat FLQ3 Howiehills (F8 and F13);
- Quadrat FLQ4 Burn of Muchalls (FL3, F15 and F16);
- Quadrat FLQ5 Burnhead (outside the study area);
- Quadrat FLQ6 Balnagubs (outside the study area);
- Quadrat FLQ7 Crossley (F22); and
- Quadrat FLQ8 Polston (F27).

40.3.61 These data account for approximately 17% of the study area. Due to programming requirements and alignment changes resulting from the Stage 1 Assessment, Quadrat FLQ5: Burnhead and Quadrat FLQ6: Balnagubs are located entirely outside the study area while Quadrat FLQ7: Crossley and Quadrat FLQ8: Polston are located partially within the route corridor.

40.3.62 Twenty-seven key bird species were recorded throughout the study area (refer to Table 40.9). One of the species was CWA1i status (snow bunting *Plectrophenax nivalis*), which was recorded (not breeding) in section FL3 at Stranog Hill in F22. Six of the key species recorded were of JNCC Red List/UK BAP status, four were of Red List only status and 16 were JNCC Amber List status including curlew (*Numenius arquata)* and lapwing (*Vanellus vanellus)*, which additionally have local BAP status.

Table 40.9 – Records of Key Bird Species (ordered by status)

Species	Scientific Name	Status	Location/Description
Snow bunting	*Plectrophenax nivalis*	WCA1i, JNCC Amber list,	Recorded in Quadrat FLQ7 at Stranog Hill.
Bullfinch	*Pyrrhula pyrrhula*	JNCC Red list, UK BAP, LBAP	Recorded at Limpet Burn and Kempstone Hill.
Linnet	*Carduelis cannabina*	JNCC Red list, UK BAP	Recorded as an incidental observation at South Fishermyre (F10) and throughout the study area in all SOVs except south FIshermyre and in Quadrats FLQ7 and 8.
Reed bunting	*Emberiza schoeniclus*	JNCC Red list, UK BAP	Recorded as an incidental observation at North Fishermyre (F12) and in Quadrats FLQ5, 7 and 8.
Skylark	*Alauda arvensis*	JNCC Red list, UK BAP	Recorded as an incidental observation throughout the study area and in South Fishermyre, North Fishermyre, Harecraig and Cookney SOVs and in Quadrats FLQ1, 3 and 8.
Tree sparrow	*Passer montanus*	JNCC Red list, UK BAP	Recorded as an incidental observation only, east of Red Moss of Netherley (F18).
Song thrush	*Turdus philomelos*	JNCC Red list, UK BAP	Recorded as an incidental observation at F12 at all SOVs and Quadrats FLQ1, 4 and 8.
Yellowhammer	*Emberiza citrinella*	JNCC Red list	Recorded as an incidental observation at South Fishermyre (F10), and at all SOVs and Quadrats 2, 3 and 8.
House sparrow	*Passer domesticus*	JNCC Red list	Recorded as an incidental observation at South Fishermyre (F10) and Quadrats FLQ1, 4 and 5.
Starling	*Sturnus vulgaris*	JNCC Red list	Recorded at Kempstone Hill, South Fishermyre, North Fishermyre SOVs and Quadrats FLQ5 and 6.
Grasshopper warbler	*Locustella naevia*	JNCC Red list	Recorded as an incidental observation at Coneyhatch (F8) at South Fishermyre (F10).
Curlew	*Numenius arquata*	JNCC Amber list, L BAP	Recorded as an incidental observation at North Fishermyre (F12) and at South Fishermyre SOV (F10) and in Quadrats FLQ3, 5 and 7.
Lapwing	*Vanellus vanellus*	JNCC Amber list, L BAP	Recorded as an incidental observation near Elrick Farm in F16, at all SOVs except North

Species	Scientific Name	Status	Location/Description
			Fishermyre (F12) and also in Quadrat FLQ4.
Common snipe	*Gallinago gallinago*	JNCC Amber list	Recorded at Quadrat FLQ7.
Cuckoo	*Cuculus canorus*	JNCC Amber list	Recorded as an incidental observation near Howieshill in F10 and at South Fishermyre SOV (F10).
Stock dove	*Columba oenas*	JNCC Amber list	Recorded as an incidental observation at Mains of Ury (F1) and in Quadrats FLQ6 and 8.
Goldcrest	*Regulus regulus*	JNCC Amber list	Recorded in Quadrats FLQ4 and 8
Dunnock	*Prunella modularis*	JNCC Amber list	Recorded at all SOVs except South Fishermyre (F10) and also in Quadrats FLQ4, 6 and 8.
Meadow pipit	*Anthus pratensis*	JNCC Amber list	Recorded as incidental observation throughout the study area, in all SOVs and in Quadrats FLQ3, 5 and 8.
Lesser black-backed gull	*Larus fuscus*	JNCC Amber list	Recorded as incidental observation throughout the study area.
Herring gull	*Larus argentatus*	JNCC Amber list	Recorded as incidental observation throughout the study area.
Oystercatcher	*Haematopus ostralegus*	JNCC Amber list	Recorded as a pair of incidentals near Cookney on the boundary of F18, in North Fishermyre SOV and in Quadrats FLQ1, 4 and 6.
Redstart	*Phoenicurus phoenicurus*	JNCC Amber list	Recorded at Limpet Burn SOV (F7).
Sand martin	*Riparia riparia*	JNCC Amber list	Recorded at Limpet Burn SOV (F7).
Swallow	*Hirundo rustica*	JNCC Amber list	Recorded at all SOVs except Cookney and Limpet Burn SOV (F7), and also in Quadrats FLQ4 and 6.
Willow warbler	*Phylloscopus trochilus*	JNCC Amber list	Recorded in all SOVs except for Cookney and also in Quadrats FLQ2, 4, 6 and 8.
Mistle thrush	*Turdus viscivorus*	JNCC Amber list	Recorded at Kempstone Hill SOV and in Quadrat FLQ8.

40.3.63 Of the SOVs, South Fishermyre (F10) recorded the most species (15 out of 27), among which were linnet (incidental at the SOV) and reed bunting (Red List/UKBAP species), yellowhammer and house sparrow (both as incidentals, Red List) and curlew and lapwing (Amber List LBAP species). Lesser black backed and herring gull were recorded as incidentals throughout the study area.

40.3.64 North Fishermyre (F12) supported the second most species (14), similar in composition to those of South Fishermyre. General incidental sightings in these areas were also high, with most activity being clustered around the wet woodland at the boundary of these two Habitat Areas.

40.3.65 Limpet Burn (F7) and Kempstone Hill (F9) recorded ten and eleven species respectively. These were the only SOVs to found support bullfinch (Red List, UKBAP, LBAP species) while Limpet Burn was the only SOV to support redstart and sand martin. Kempstone was the only SOV found to support mistle thrush (Amber List). The wet woodland surrounding Limpet Burn and the gorse and willow scrub on acid grassland and heath on Kempstone Hill provide suitable foraging and breeding opportunities.

40.3.66 The wet willow habitat at Harecraig SOV supported nine of the species while the heath and bog habitat surrounding Cookney SOV supported seven.

40.3.67 Quadrat 8 (Polston) supported the most species (13 species). This quadrat covers F27 surrounding the banks of Crynoch Burn, which provides foraging opportunities in mesotrophic semi-improved grassland, some riparian woodland and gorse. Of the Quadrats wholly within the study area, Quadrat 4 (F13, F15 and F16) surrounding the Burn of Muchalls was found to support ten key species. Although this area is largely agricultural land, it has been managed sensitively

with new or recently planted hedgerows, woodlands, scattered trees and ponds. Gorse scrub and newly planted hedgerows in Quadrat 3 at Howiehills (F8 and F13) supported six species.

Otter

40.3.68 The European otter (*Lutra lutra*) is fully protected by UK law through inclusion in Schedule 5 of the WCA (1981) and Schedule 2 of the Conservation (Natural Habitats & c.) Regulations 1994. Under this legislation, it is an offence to *inter alia* intentionally or recklessly kill, injure or disturb otters, and/or intentionally or recklessly obstruct, damage or destroy otter holts or couches. The otter is also listed on Appendix 1 of the Convention on International Trade of Endangered Species (CITES), Appendix II of the Bern Convention and Annexes II and IV of the Habitats Directive. The otter is a priority species in the UK BAP. However, the otter is not threatened or rare in the region or county and is not an NES LBAP priority species.

Consultation and Literature Review

40.3.69 National population surveys of otters were carried out from 1977 to 1979, 1984 to 1986 and 1991 to 1994 in response to a perceived decline in numbers. In the 1991-1994 survey, otters were recorded at 88% of sites surveyed in Scotland, representing a rise of 15% over the results from the first survey (Green and Green, 1997). Otters are now believed to be present in every river catchment in Scotland (Grogan et al., 2001).

40.3.70 The National Otter Survey of Scotland 1991-1994 (Green and Green, 1994) identified a rise of 2% in the number of positive sites in the Grampian region. The majority of negative sites (i.e. no otters recorded) were along isolated coastal fringes.

40.3.71 The National Biodiversity Network revealed records of the presence of otters in five of the six main 10km grid squares in the study area.

40.3.72 Most of the consultees possessed no records of otters in the study area, although the Kincardine Rural Community Council provided some records of otter sightings (included in the Survey Results section) and a number of landowners and local residents provided comments about the otters in the area.

Field Survey

40.3.73 As otter populations may be limited by prey abundance, areas possessing or allowing access to optimal foraging habitat are judged to be of key importance. Factors likely to affect the availability of prey items, such as water quality would be likely to affect the suitability of an area for otters. Favourable habitat for otters is indicated by good vegetative cover and low likelihood of disturbance. Areas possessing sub-optimal foraging habitat but with other habitat qualities (e.g. low levels of disturbance and dense riparian cover) are of lesser importance, as they are less likely to be vital to local otter survival (Kruuk et al., 1993).

40.3.74 Otter activity in the study area is centred on Limpet Burn, the Burn of Muchalls and the Burn of Elsick, although signs of otters were present along most of the watercourses in the section. Both Fishermyre Pond and Crossley Pond, which are outside of the study area, appear to be used by otters.

40.3.75 Signs of otters including spraints, prints and potential lying up sites were also recorded in ponds and small ditches adjacent to the main watercourses at the Burn of Muchalls and the Burn of Elsick. These are considered to extend the foraging and lying up resource provided by the main burns.

40.3.76 Although no confirmed holts were recorded within the study area, five couches were identified along Back Burn, the Burn of Muchalls and the Burn of Elsick. Many more holes, tree roots, boulders and areas of scrub and other vegetation suitable for lying up were found along most other watercourses.

40.3.77 It is not possible to draw any conclusions about the number or the sex of otters present in the study area in the absence of definitive observational evidence (Chanin, 2003). However, evidence from prints indicated that there are at least two otters belonging to an adult and juvenile, which were recorded along the Burn of Muchalls. It is possible that otters in this section explore widely over the area using terrestrial routes to cross between water features where they are not contiguous.

Red Squirrel

40.3.78 Red squirrels (*Sciurus vulgaris*) are protected by UK law through inclusion on Schedule 5 and 6 of the WCA (1981) which has been amended by the Nature Conservation (Scotland) Act 2004. This makes it an offence to intentionally or recklessly kill, injure, take or possess a wild red squirrel, or to intentionally or recklessly damage, destroy or obstruct access to any structure or place used by a red squirrel for shelter or breeding. It is also prohibited to intentionally or recklessly disturb a red squirrel while it is occupying a structure or place for protection, or to kill or capture red squirrels by indiscriminate methods such as snaring or poisoning. The red squirrel is further protected by the Wild Mammals (Protection) Act 1996 and through inclusion in Appendix III of the Bern Convention. The red squirrel is listed as a Priority Species on the UK BAP and is also an NES LBAP species (Legge, 2004).

Consultation and Literature Review

40.3.79 The consultation exercise yielded no records of red squirrels within or in the vicinity of the study area.

Field Survey

40.3.80 The following is a summary of the baseline conditions with respect to red squirrel populations in the vicinity of the proposed scheme, more details are provided in Appendix A40.6. Aberdeenshire is on the edge of the current northern distribution of the grey squirrel, which competes with the red squirrel where the two occur together. Grey squirrel is a carrier of the Squirrelpox virus that is potentially fatal for the red squirrel, whilst the grey squirrel appears unaffected. This virus has been considered to be a major factor in the replacement of reds by greys (Rushton et al., 2000; Tompkins et al., 2003). Although the first incidence of Squirrelpox virus in Scotland was recorded from a grey squirrel in the Borders, in August 2001, as of yet, the disease has not been detected in red squirrels in Scotland (SNH, 2004). Therefore in Scotland, the replacement of red squirrels with grey squirrels is thought to be more likely to be due to direct competition.

40.3.81 Six woodlands were surveyed using visual and hair-tube surveys as detailed in paragraph 40.2.44. These woodlands were Limpet Wood (F7), Megray Wood (F6), Fishermyre Wood (F10), Fishermyre Wood North (F11), East Crossley Wood (F24) and Craigentath Wood (outside the study area). The surveys provided no evidence of red squirrel presence within the woodlands surveyed. However, an individual was sighted in a broadleaved woodland strip on the west side of the B979 on 5 July 2006, approximately 50m west of Megray Wood, which is on the edge of the study area (grid reference NO 87158869).

40.3.82 In general, small, isolated woodlands, such as Fishermyre (F10) and Fishermyre Wood North (F11) are unlikely to be used by red squirrels. Megray Wood is a dense, semi-mature Sitka spruce plantation, which is common in Aberdeenshire. This offers limited resources for red squirrels but such areas are considered to provide refuge habitat due to their unsuitability for grey squirrels (Scottish Squirrel Group, 2004). The red squirrel sighting may indicate that red squirrels are utilising Megray Wood intermittently.

Water Vole

40.3.83 The water vole (*Arvicola terrestris*) is afforded partial protection by the WCA (1981) through inclusion in Schedule 5, which makes it an offence to intentionally damage, destroy or obstruct access to any structure or place that water voles use for shelter or protection, or to disturb water voles while they are using such a place. A recent JNCC review of the Wildlife and Countryside Act

(1981) (as amended) in 2005 recommended full protection in Schedule 5. This would provide a similar level of protection to species such as otter. However, a date for ratification of these amendments has not yet been set.

Consultation and Literature Review

40.3.84 Water vole are known to be present in the wider area of North East Scotland and the 1996 National Water Vole Survey found remnant water vole populations present at a few isolated locations in the Upper Dee catchments (Jefferies, 2003). Water vole colonies were also identified in low numbers in other river catchments in North East Scotland including lowland farmland of Buchan and tributaries of the River Ythan.

40.3.85 SNH reported that water vole have been sighted north of Stonehaven (reported by SNH via Mr David MacDonald from the Stonehaven and District Angling Association).

Field Survey

40.3.86 No previous water vole surveys were carried out within the route corridor. However, otter surveys by Jacobs commenced in February 2006. During the otter surveys, water vole signs were identified at a Fishermyre Pond. No other water vole signs were recorded during these surveys, which extended as far south as Stonehaven. Based on this, a full water vole survey of the study area was undertaken at the appropriate time of year as stated in Section 40.2.

40.3.87 The following is a summary of baseline conditions with respect to water vole in the vicinity of the proposed scheme, further details of habitat assessment are given in Appendix A40.7. Of the 21 sites surveyed, only five waterbodies exhibiting high suitability for water voles were identified. These were recorded at Coneyhatch Burn, Green Burn and Green Ditch, the drainage ditch at Fishermyre Moss, Fishermyre Moss and Fishermyre Pond.

40.3.88 All five areas identified as being of high value habitat for water voles are located within 1km of each other. These locations are hydrologically linked to one another via Fishermyre Moss and wet grassland around Fishermyre Farm.

40.3.89 Signs of water vole were found at four of the sites identified as having high suitability. These are at Green Burn (Waterbody 5), within a dry ditch on Fishermyre Moss (Waterbody 6), on a drain at Fishermyre Moss (Waterbody 7) and at Fishermyre Pond (Waterbody 8). Full details of the signs recorded are presented in Appendix A40.8 (Water Vole Report).

40.3.90 Six of the sites were identified as offering either low or low/moderate habitat suitability for water voles, whilst ten were identified as being of moderate suitability. Signs of mink were not observed at the sites where water vole signs were recorded, but are present in other areas throughout the study area.

40.3.91 Using Lambin et al., (unpublished) water vole population equation (which determines water vole activity and number by using the number and distribution of latrines), an index of activity was produced for three of the four sites (no latrines were found at Fishermyre wetland). The results suggest that the water vole population at each of the colonies is small (perhaps as small as 1-2 breeding females per colony). This number may be an under-representation as water voles may not be maintaining latrines and may be defecating within their burrow systems.

40.3.92 The habitat between the four positive sites comprises of peat bog at Fishermyre wetland and wet grassland at Fishermyre Farm. These habitats provide connectivity and promote maintenance of genetic variability, as dispersing water voles will travel over land as well as along waterbodies (Telfer et al., 2001). Dispersal is of particular importance given the assumed small colony size.

40.3.93 The three identified colonies and assumed colonies at Fishermyre Moss are partially severed by two existing roads. A C-road separates the colony at Green Burn from the colony at Fishermyre Moss, whilst the B979 separates Fishermyre Pond from Fishermyre Moss. However, the width of

these roads is narrow (approximately 6m) and it is likely that water voles will attempt to cross these roads when dispersing.

Water Shrew

40.3.94 The water shrew (*Neomys fodiens*) is protected by the Wildlife and Countryside Act (1981) (as amended) through inclusion in Schedule 6, which prohibits killing and certain methods of capture. Water shrews are found throughout Britain, but appear to have a patchy, localised distribution, particularly in northern Scotland (Harris et al., 1995; Greenwood et al., 2002).

Consultation and Literature Review

40.3.95 SNH, Aberdeen City Council, the NES LBAP Co-ordinator and NESBReC held no records of water shrew within 10km of the study area. However, one dead water shrew was recorded during surveys of the study area for the Northern Leg section of the AWPR (refer to Chapter 10: Ecology and Nature Conservation).

Field Survey

40.3.96 No evidence of water shrew was recorded in the Fastlink survey area. Nine watercourses were identified as having the potential to provide suitable conditions for water shrew populations (refer to Appendix 40.9 and Figures 40.13a-f).

Amphibians

40.3.97 All six species of amphibian native to the UK are subject to legal protection, although the level and type of protection varies between species. Great crested newt (*Triturus cristatus*) and natterjack toad (*Bufo calamita*) are protected from killing and injury, and disturbance to their habitats through their inclusion in Appendix 5 of the Wildlife and Countryside Act (1981) (as amended) and the Conservation (Natural Habitats & c.) Regulations 1994. Smooth newt (*Triturus vulgaris*), palmate newt (*Triturus helveticus*), common frog (*Rana rana*) and common toad (*Bufo bufo*) are protected from being sold through inclusion in Appendix 5 of the Wildlife and Countryside Act (1981) (as amended).

Consultation and Literature Review

40.3.98 Consultation with SNH, Aberdeen City Council, the NES LBAP Co-ordinator, NESBReC and the local herpetofauna recorder (Mr Bob Laing) did not identify any historic records of amphibians within the study area. There are no historical records of great crested newt within 50km of Aberdeen (Arnold, 1995).

Field Survey

40.3.99 Analysis of the Phase 1 Target Notes, Ordnance Survey maps and aerial photos allowed waterbodies and potential amphibian terrestrial habitat to be identified. Incidental sightings of two amphibians were recorded. The first sighting was of a juvenile palmate newt found in terrestrial habitat around Fishermyre Pond E, (NGR NO 870 897). The second sighting was of a common toad found in terrestrial habitat next to Crossley Pond (NGR NO 865 963).

40.3.100 A total of five ponds were identified within 500m of the route corridor, as well as areas of suitable terrestrial habitat. These ponds and surrounding terrestrial habitat were assessed in terms of their suitability for amphibians (Table 40.10 and Figures 40.10a-f).

40.3.101 Within Section FL1, two ponds were found, which were named Fishermyre Ponds East (E) and West (W). The main pond (W) is approximately 1ha in size and approximately 20-30cm in depth near the edges, but deepens to over 50cm near the centre. The pond fringes mainly comprises of reeds with shallow sloping banks (approximately 20^{o}), which are approximately 30cm in height. Another wet flush is located between the western end of the pond and the Burn of Monboys, which

lies approximately 500m west of the pond (W). The area is generally wet and is adjacent to Fishermyre wetland. Fishermyre Pond E is smaller, being approximately 72m^2 and roughly rectangular in shape. It is approximately 1m deep at the eastern end and progressively shallows towards the western edge. It is lined with juncus and herbs and the surrounding habitat is marshy grassland.

Table 40.10 – Aquatic and Terrestrial Amphibian Habitat Assessment

Habitat Area	Pond Name	Aquatic and Terrestrial Habitat Description
FL10	Fishermyre Pond E	Small natural pond being approximately 72m^2 and roughly rectangle in shape. It is lined with juncus and herbs and the surrounding habitat is marshy grassland.
Outwith	Fishermyre Pond W	Approximately 1ha in size and approximately 20-30cm in depth near the edges, but deepens to over 50cm near the centre. The pond fringes mainly comprises of reeds, with shallow sloping banks (approximately 20^o), which are approximately 30cm in height. The area is generally wet and is adjacent to Fishermyre wetland.
FL15	Elrick Pond Large	Adjacent to the Burn of Muchalls, this is a large pond with emergent vegetation and shallow, sloping banks. A species rich hedgerow provides a dispersal corridor to other areas.
FL15	Elrick Pond Small	Smaller pond adjacent to the Burn of Muchalls. The margins are dominated by bulrush and the surrounding habitat includes marshy grassland and mixed plantation.
Outwith	Crossley Pond	Managed recreational fishing pond surrounded by coniferous plantation and some heath that provides habitat for foraging and shelter.

Brown Hare

40.3.102 Brown hare (*Lepus europaeus*) are offered limited protection by the Ground Game Act 1880, Hare Preservation Act 1892 and the Wild Mammals (Protection) Act 1996 against 'unnecessary suffering', but there is no legal protection from being killed in a 'swift and humane way'. However, they are a priority UK BAP species and an NES LBAP species due to their general decline caused by changes in farming practices and hunting.

Consultation and Literature Review

40.3.103 There were no recent records of brown hare for the study area or vicinity.

Field Survey

40.3.104 There have been sightings of one hare just outside the study area in fields to the south of Limpet Burn (F7), two hares north of Elrick farm (F16) and four separate sightings of a total of 12 individuals near Burnside of Newhall (F18). A further two sightings of a total of six individuals were recorded just outside the alignment (less than 200m from the proposed route corridor) west of Berry Top and Stranog Hill (Figures 40.11a and b).

40.3.105 Some habitat provision for hares was identified in a mixture of pasture, woodland, dense and scattered scrub, cereals, root crops and set-aside, providing a varied food source. During the summer, long cereals with scrubby boundaries provide good cover for adults and leverets and the pasture areas provide good grazing conditions. In the winter, root crops and winter cereal crops provide cover and food and the woodlands provide further shelter from severe weather. Throughout the survey area however, many of the fields are large (greater than 2ha) meaning that hares need to move greater distances for food and shelter.

40.3.106 In Section FL3, Habitat Area F18 provides the greatest diversity of crops and the best potential cover with a mixture of large pasture fields, scrub and marshy fields to the north of Burnside of Newhall, extending westward to South Rothnick and northward to West Quoscies and providing close to optimal foraging. Cover in the form of gorse boundaries, willow scrub and rush thickets are present. Habitat Area F8 also offers habitats high in suitability due to many small crop fields directly east of Broomhill Farm, extending eastward toward the Burn of Muchalls and providing

varied foraging. There is excellent cover in this area in the form of set-aside ground, ditches, field boundaries and dense gorse thickets. The remainder of the Habitat Areas within the study area as a whole are of low to medium suitability for brown hare due to lack of cover.

Reptiles

40.3.107 There are six species of reptile native to the UK: the common lizard (*Lacerta vivipara*), sand lizard (*Lacerta agilis*), slow-worm (*Anguis fragilis*), smooth snake (*Coronella austriaca*), grass snake (*Natrix natrix*), and adder (*Vipera berus*). In addition, there are several introduced species arising from escapes or illegal releases, which may be encountered occasionally (English Nature, 2004). Common lizard, slow-worm and adder are common and widespread throughout the UK and receive limited protection under the WCA (1981) as amended, which makes it an offence to intentionally or recklessly kill or injure these animals. The Act was amended by the Nature Conservation (Scotland) Act 2004, which added the word 'recklessly' to the previous legislation.

Consultation and Literature Review

40.3.108 The only reptile species recorded within 50km of Aberdeen are the common lizard, slow-worm and adder (Arnold, 1995; Reading et al., 1995; Reading et al., 1996). A questionnaire survey carried out in 1992 recorded adders in all 10km^2 grid squares around Aberdeen, (Reading et al., 1995; Reading et al., 1996).

40.3.109 A review of information from the National Biodiversity Network (NBN) revealed no records of reptiles within any of the10 km^2 grid squares that the road alignment passes through.

Field Survey

40.3.110 One incidental sighting of a common lizard was made in Section FL1, in the vicinity of Limpet Burn (NGR NO 877 889).

40.3.111 Analysis of the Phase 1 Target Notes, Ordnance Survey maps and aerial photos allowed potential reptile habitat to be identified (see Figures 40.10a-f).

40.3.112 Section FL1 contains the largest amount of suitable habitat, in Habitat Areas F6, F7, FL9, F10, F11 and F12. The area forms an expanse of scrub, heath, acid grassland and broadleaved woodland that provides extensive foraging habitat and also refuge and hibernation sites. The area is almost entirely connected, allowing reptiles to move between the different areas of habitat.

40.3.113 Section FL2 contains comparatively less suitable habitat. There are small areas within Habitat Areas F14 and F16 that comprise dry heath and improved fields edged by new hedges. While the habitat is suitable, it is isolated from other areas, which reduces their importance. Habitat Area F15 provides extensive habitat made up of a species rich hedgerow, broadleaved plantation and marshy grassland.

40.3.114 Habitat Areas F17 and F19 are both large, providing areas of heath and scattered scrub that are of benefit for reptiles. Parts of F22 and F23 form a continuous corridor of habitat that includes dry heath, scattered and dense scrub. Dry heath habitat occurs in F24 in small patches. At the end of this section, F27 links up with extensive habitat in Section SL3 of the Southern Leg of the scheme (refer to Appendix A25.10). Collectively, they form a continuous area of extensive habitat that contains scrub and heath.

Terrestrial Invertebrates

40.3.115 A number of terrestrial invertebrates are included in Schedule 5 of the Wildlife and Countryside Act (1981) (as amended) and the Nature Conservation (Scotland) Act (2004), which gives them full or part protection. These include species of beetles, butterflies, moths, true bugs, crickets, dragonflies, spiders, annelid worms and molluscs. Invertebrates are important in both ecosystem

functioning and in agricultural systems. As pollinators, herbivores, predators, parasites and as a food source for other species, they are a vital element in terrestrial food chains.

Consultation and Literature Review

40.3.116 A combination of North East Scotland Biodiversity Audit Data (2003), NESBAP and UK BAP data, and local entomologist recorder information were used to produce a list of potential invertebrates of local significance. NESBReC currently only holds non-confidential records of two of these species near Aberdeen: the pyralid moth (*Catoptria permutatella*) and sword-grass moth (*Xylena exsoleta*). Records for other species are held, but most of these are from upper Deeside or the Morayshire coast.

Field Survey

Section FL1

40.3.117 This section is dominated by arable farmland with species-rich cereal margins. In general, biodiversity around these farming sites is concentrated in shelter belts and fragments of plantation woodland. The area may support Coleoptera, Diptera, Lepidoptera, Araneae and Hymenoptera.

40.3.118 Limpet Burn is bordered in some areas by wet woodland, which stretches into the conifer plantation woodland of Megray Wood. A number of wetland habitats are present in Fishermyre Wood (including wet woodland, heath, fen and marsh), which is a semi-natural broad-leaved woodland co-dominated by rowan and birch. The woodland near Coneyhatch Farm is comprised of similar species, with goat willow co-dominant with birch. A number of locally important Lepidoptera feed on willows and alders in wet grassland. Habitats in this area may support Araneae, Coleoptera, Diptera, Isopoda, Tricoptera and Lepidotera.

40.3.119 Scattered gorse and hawthorn scrub occurs occasionally in field boundaries, roadsides and lining the railway line to the south. Dense gorse is particularly notable around Fishermyre Wood, lining both the heathland and birch wood. Although not of local importance, the broom-tip moth (*Chesias rufata*), which has declined dramatically in national terms, feeds on gorse species and may occur in this area.

40.3.120 Mesotrophic grassland occurs on a small hill in this section, whilst in the lower areas near conifer plantation woodland and gorse scrub, acid grassland is the dominant semi-improved grassland habitat. Acid grassland is occasional within the drier areas of Fishermyre Wood. The acid grassland has the potential to support Araneae, Coleoptera and Lepidoptera, particularly species of local importance; pearl-bordered fritillary (*Boloria euphrosyne*), sword-grass moth (*Xylena exsoleta*) and the subterranean spider *Lepthyphantes insignis*.

40.3.121 Limpet Burn is a heavily vegetated stream flowing through valuable wet woodland and marsh habitat, as well as scrub and grassland, which links to Megray Burn. Species-rich wet woodland occurs at the confluence, although this eventually degrades into conifer plantation. Fishermyre Burn is largely a field drainage system, bordering marsh to the north. Green Burn supports a fen and wet woodland, as well as marsh. Invertebrates supported in this area may include Diptera, Hymenoptera, Lepidoptera and Odonata.

Section FL2

40.3.122 Improved and arable fields comprise most of this section. Dry stone wall lining occurs in most fields, with occasional hedges. Small pockets of scrub are rarely present, as are marsh/marshy grassland communities. Most of the wooded environment is limited to the riparian zone of the Burn of Muchalls, which contains young mixed plantations in the west and semi-natural wet woodland in the east. The dry stone walls may support the mountain whorl snail (*Vertigo alpestris*) and the wall whorl snail (*Vertigo pusilla*).

40.3.123 The immediate surrounds of the Burn of Muchalls contain a young plantation of Scots pine and a variety of broad-leaved species. Other plantation is found at Elrick Wood, which is composed of Sitka spruce plantation. The north of the woodland is comprised mainly of mature trees, whilst the south is relatively recently planted. This area may support a variety of Coleoptera and Araneae.

40.3.124 Riparian habitat surrounding the Burn of Muchalls includes semi-natural wet woodland consisting of rowan, alder and willow in the eastern section. Young mixed plantation woodland in the western section consists of Scots pine, birch, rowan, hazel, whitebeam, a number of willow species, bird cherry and wild cherry. A number of locally important Lepidoptera feed on willows and alders in wet grassland.These habitats may support Odonata, Lepidoptera, Araneae, Hymenoptera and Coleoptera.

40.3.125 The agricultural land present is predominantly improved grassland or grasses cropped for silage. Small areas of mature mixed plantation woodland and shelter belts occur throughout, which are co-dominated by beech and Scots pine and occasional patches of dense gorse scrub. This habitat may support Diptera, Coleoptera and Araneae. The subterranean spider, *Lepthyphantes insignis* is of local significance and may be supported here, as it is associated with arable land.

Section FL3

40.3.126 Improved grassland is dominant with arable land abundant. Wetter habitats consisting of bog, heath, marsh, acid grassland and riverine mesotrophic grassland are frequent. Many fields are lined with dry stone walls, hedges and/or shrubs/trees. Pockets of dense scrub are frequent in the mid-section with limited woodland, which is largely confined to a young plantation.

40.3.127 Wet habitats to the north of Cookney comprise patches of bog and heath, characterised by hare's-tail cotton-grass (*Eriophorum vaginatum*) humps with abundant heather (*Calluna* sp.) and common cotton grass (*E. angustifolium*) dominant in the bog pools. The moss species are predominantly *Sphagnum spp*. Areas of wet and dry heath occur throughout this habitat, consisting of heather, cross leaved heath (*Erica tetralix*), crowberry (*Empetrum nigrum*), bilberry (*Vaccinium myrtillus*) and occasional purple moor grass (*Molinia caerulea*). S*phagnum spp.* are not a major constituent of the heathland habitats, being mostly confined to bog pools. Potential invertebrates in this area are Lepidoptera, possibly the large heath butterfly (*Coenonympha tullia*), pearl-bordered fritillary, small pearl-bordered fritillary (*Boloria euphrosyne*), sword-grass moth and kentish glory moth (*Endromis versicolara*). Hare's-tail cotton-grass is the food plant of large heath butterfly. Coleoptera and Araneae, such as the locally significant *Lepthyphantes insignis*, may also inhabit this area.

40.3.128 Habitat Area F18 is a large area of predominantly improved grassland with occasional arable farms. Marshy grassland is present though rare. Scrub is present throughout and usually scattered around field edges and boundaries however, dense pockets of continuous gorse scrub are also present. This habitat may support Lepidoptera, Hymenoptera, Diptera, Coleoptera and Araneae. The subterranean spider *Lepthyphantes insignis*, associated with arable land, is of local significance and has potential to be present in this area. Although not of local importance, the broom-tip moth has declined dramatically in national terms; it feeds on gorse species and may occur here.

40.3.129 The marshy grassland dominated by soft rush and grasses has the potential to support a range of Araneae, Coleoptera and Lepidoptera.

40.3.130 The wet habitats around East Crossley grade from soft rush dominated sheep grazed fields (in the north particularly) to a richer dry heath/acid grassland mosaic dominated by wavy-hair grass (*Deschampsia flexuosa*) and ericoids, plus cotton grasses. Scrub is frequent and is particularly invasive within the dry heath habitat. This area may support Araneae, Coleoptera and Lepidoptera.

40.3.131 Agricultural fields from Quoscies to Stranog comprise a series of improved fields. Soft rush (*Juncus effusus*) is prominent in the mid-section, whilst scattered and dense gorse scrub is the distinguishing feature in the north. This habitat has the potential to support Araneae, Coleoptera

and Lepidoptera. Although not of local importance, the broom-tip moth has declined dramatically in national terms, it feeds on gorse species and may occur here.

40.3.132 A Habitat Area of dry heath/acid grassland mosaic on level area of ground is present in F23. Grassland dominates overall with scattered shrub occasional. Patches of wet heath leading onto bog are also present. Potentially this area may support Araneae, Coleoptera and Lepidoptera. Locally important invertebrate potential in this area includes pearl bordered fritillary, large heath butterfly, small pearl-bordered fritillary, sword-grass moth and kentish glory moth and the subterranean spider *Lepthyphantes insignis*.

40.3.133 Bog/heath to the immediate west of Wedderhill comprises wet modified bog, which is the dominant habitat and of higher value in the western section. The eastern section of this area is more modified, containing areas of dry heath, wet birch woods and scattered broad leaves and conifers. A small vegetated burn is present with a pool of standing water. This area may support Odonata, Lepidoptera, Coleoptera, Araneae, Diptera, Isopoda and Tricoptera.

40.3.134 The floodplain and immediate surrounds of Crynoch Burn is dominated by mesotrophic semi-improved grassland to the south, giving way to improved fields with abundant gorse scrub. This area may support Araneae, Coleoptera and Lepidoptera. Although not of local importance, the broom-tip moth has declined dramatically in national terms; it feeds on gorse species and may occur here.

Freshwater Macroinvertebrates and Aquatic Habitats

Consultation and Literature Review

40.3.135 SEPA monitors a number of the watercourses in for water quality and biological measures and has recent river classifications for two relevant watercourses along the route. These data have been used in the impact assessment both in terms of aquatic ecosystem health and water quality. A summary of SEPA's biological data is presented below (Table 40.11) and Chapter 39 (Water Environment) contains details of locations of SEPA sampling points.

Table 40.11 – Summary of SEPA Biological Data

Route Section	Watercourse	Year	Classification
FL2	Back Burn	2005	A2
FL2	Burn of Muchalls	2005	A2
FL3	Burn of Elsick	2005	A2

40.3.136 In addition to baseline information obtained from SEPA, physical parameters were also considered for each watercourse. The Burn of Muchalls is the largest watercourse in the study area in terms of catchment area and discharge. A number of smaller streams have very low mean flows, suggesting that they may be ephemeral, drying out during certain periods of the year, particularly Megray Burn, Whiteside Burn and Crossley Burn. A simple measure of the variation in mean monthly velocities for each watercourse indicated that the most 'flashy' watercourse (i.e. that with the most variable flow) is Crossley Burn.

Field Survey

40.3.137 Baseline information is the result of a combination of macroinvertebrate sampling and River Habitat Survey (RHS) data. Macroinvertebrate surveys were undertaken in June 2006 with sampling points indicated on Figures 40.13a-h. Repeat sampling was undertaken in September 2006. RHS was undertaken in June 2006 to record the physical parameters of 500m long sections of each of the watercourses that would be crossed by the proposed scheme. Locations of the RHS reaches are shown in Figures 40.11a-h.

Section FL1

40.3.138 Megray Burn possesses variable aquatic and riparian habitat flowing through woodland at the upstream end with a field boundary downstream. Upstream and downstream reaches of the burn were sampled for macroinvertebrates with the resulting ASPT score indicating good ecological health. The fauna comprised a range of pollution tolerant and intolerant families including caddis flies, mayflies, bloodworms, true fly larvae and adult and larval beetles. Megray Burn is categorised as significantly modified using RHS data as the surveyed reach is extensively realigned and over-deepened with extensively re-sectioned banks and the presence of a major sluice.

40.3.139 Limpet Burn downstream of the proposed crossing point is classed as pristine according to RHS, as it is not modified in any way. For most of the surveyed reach, the watercourse did not flow via a formed channel but seeped through wet grassland in a steep, u-shaped valley. Limpet Burn upstream of the proposed crossing point is classed as obviously modified using RHS data, due to the presence of a culvert and some bank re-sectioning.

40.3.140 Green Burn is a small burn flowing through heathland and rough pasture that was sampled very close to its source, where the channel was narrow though supported a moderate flow. The ASPT score resulted in a classification of poor ecological health. The fauna comprised mayflies, beetles, bugs, and caddis flies, which are all largely pollution tolerant species. This watercourse is classed as obviously modified using RHS data, largely due to the presence of a culvert under a road.

Section FL2

40.3.141 Allochie Burn was found to be in good ecological health according to the ASPT score. The faunal assemblage comprised of caddies flies, stoneflies, mayflies, snails, beetles and true bugs. These taxa showed variations in flow preferences and also in pollution tolerance. No RHS was undertaken for Allochie Burn as it was identified to be a field drain.

40.3.142 Back Burn runs through agricultural land before flowing into the Burn of Muchalls. Back Burn was found to be of excellent biological status according to ASPT scores, which is an improvement on the SEPA monitoring data from 2005. Back Burn is classed as significantly modified using RHS data, due to the presence of re-sectioned and reinforced banks. One intermediate weir, two minor weirs and one minor bridge were observed along the surveyed reach.

40.3.143 The Burn of Muchalls was found to be of good biological status and was dominated by pollution intolerant flow reliant species including the stonefly *Isoperla grammatica* and mayfly *Ephemerella ignita*. The Burn of Muchalls, downstream of the proposed crossing point, is classed as obviously modified using RHS data. This was due to the watercourse having been realigned historically along part of the surveyed reach, with one minor weir and one intermediate bridge also present. Upstream of the proposed crossing point, RHS classified the Burn of Muchalls as significantly modified. This was a result of the presence of a realigned channel with areas of re-sectioned and reinforced (top only) banks. One minor weir and one intermediate bridge were also observed.

Section FL3

40.3.144 The Burn of Blackbutts was classed as obviously modified using RHS data, as it is extensively realigned and over-deepened and is essentially a modified field drain.

40.3.145 Cookney Ditch was classed as significantly modified using RHS data, as a result of the reach being extensively realigned and over-deepened. It is embanked and reinforced (top only) in places.

40.3.146 Stoneyhill Burn was not surveyed due to land access issues. It was inferred to be of a similar nature to nearby Cookney Ditch; a straightened, over-deepened land drain.

40.3.147 Balnagubbs Burn was classed as significantly modified using RHS data as it is extensively realigned and over-deepened. Both banks are re-sectioned, embanked and reinforced (top only) in places.

40.3.148 The Burn of Elsick was identified as possessing good ecological health, which is consistent with the 2005 SEPA assessment. The macroinvertebrate assemblage consisted dominantly of the tolerant freshwater shrimp (*Gammarus pulex*), though other pollution intolerant species were also identified. Burn of Elsick is a drainage channel and was classed as significantly modified using RHS data due to being extensively realigned and over-deepened. Both banks are extensively reinforced and embanked.

40.3.149 Whiteside Burn was found to be in good ecological health and was classed as significantly modified using RHS data. It was extensively realigned and over-deepened.

40.3.150 Both sample sites on Crossley Burn were found to be in fair biological health. Cairns Burn was not directly sampled although it flows into Crossely Burn, therefore the health of Cairns Burn was inferred. Although Crossley Burn is a modified straightened channel, it was found to support a diverse macroinvertebrate assemblage with caddisflies, beetles and stoneflies being identified. Crossley Burn is a drainage channel that was classed as significantly modified using RHS data, due to being extensively realigned and over-deepened. Both banks are re-sectioned and there are areas of reinforcement, embankment and poaching.

40.3.151 Stranog burn and Cairnfield Burn were not sampled for macroinvertebrates or RHS as they are small, seasonally flowing field drains.

Fish

Consultation and Literature Review

40.3.152 Atlantic salmon (*Salmo salar)* are protected under the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003 which makes it an offence to knowingly take, injure or destroy any smolt, parr, salmon fry or alevin; injure or disturb any salmon spawn during the annual close time; obstruct or impede salmon passage for spawning. Atlantic salmon are also listed on Appendix III of the Bern Convention. Freshwater populations are listed on Annex II of the EU Habitats Directive and Schedule 3 of the Conservation Regulations (1994).

40.3.153 Brook lamprey (*Lampetra planeri*), river lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*) are listed in Annexes II and V of the EU Habitats Directive and Appendix III of the Bern Convention, ratified by the Wildlife and Countryside Act (1981) (as amended). They are on the UK BAP list and a draft Action Plan is in preparation. In Scotland, these species are not currently threatened, but are in decline (SNH, 2004). All remaining fish species considered to be of good status and have not been specific legal protection in the same manner.

Field Survey

40.3.154 Not all of the burns within the vicinity of the proposed route were suitable for HABSCORE (habitat scoring) (Appendix A40.13) and electric fishing assessments as they were either considered too small to support salmonids or were ephemeral. In addition, the results of electric fishing surveys conducted to confirm the presence or absence of salmon and trout are provided.

40.3.155 In Section FL1, the surveyed reach of Megray Burn appears to run dry in sections. The watercourse flows through conifer plantation and downstream through a field drain. There appears to be suitable substrate present to support fish though the amount of water present appeared to be a limiting factor. No HABSCORE assessment was completed for this burn, though electric fishing surveys were completed. The electric fishing surveys however, yielded no fish.

40.3.156 The surveyed reach of Back Burn meanders through semi-improved grassland. The channel predominantly forms small pools and riffles with large loose boulders and small waterfalls, which

are unlikely to cause major barriers to fish migration. HABSCORE assessments of the burn indicated that it is unlikely to support salmon, though all age-classes of trout are possibly present. Electric fishing results confirm the presence of trout with 0+ and 1+ age-classes being present, though no salmon were identified. No other fish species were identified in the surveys. However, suitable habitat for minnow (*Phoxinus phoxinus*) and stickleback (*Gasterosteus* sp.) was found, therefore based on the precautionary approach taken in this assessment, it cannot be assumed that they are absent.

40.3.157 In Section FL2, the Burn of Muchalls is a more natural channel flowing through semi-improved grassland with evidence of previous realignment. The channel predominantly forms large cobbles and some boulders interspersed with smaller cobbles and pebbles, with small sand banks on the margins. Suitable habitat to support lamprey was present along with bank cover for salmonids. Several small salmonids (10-12cm) were observed during the survey, possibly trout. Results of the HABSCORE assessment indicated that the burn is unlikely to support salmon, though it possibly supports all age classes of trout. Electric fishing surveys confirmed the presence of trout within the burn with 0+, 1+ and 2+ age classes being identified. No other species were found within the surveys, though the presence of suitable habitat and the precautionary approach taken in this assessment means that it cannot be assumed that they are absent.

40.3.158 In Section FL3, the surveyed reach of Crossely Burn is a small burn flowing along the edge of pasture with significant areas of poaching by livestock. Sticklebacks were observed during the habitat assessment and were also caught whilst completing kick sweep sampling. The HABSCORE assessment indicated that the burn is unlikely to support salmon, although it may possibly support all age classes of trout. No electric fishing surveys were carried out on Crossley Burn due to lack of suitable fish habitat.

Wintering Birds

40.3.159 The Birds Directive (1979) provides full protection for all Annex I species and their habitats, listing species that may be conditionally hunted in Annex II and III. Under the Wildlife and Countryside Act (1981) (as amended) all wild birds, their nests and eggs are protected. However, game birds are not included in this definition (except for limited parts of the Act, Schedule 2) and are covered by the Game Acts, which confer protection during the closed season. Schedule 1 birds that may be present along the route include Redwing (*Turdus iliacus*) fieldfare (*Turdus pilaris*) and barn owl (*Tyto alba*).

Consultation and Literature Review

40.3.160 SNH did not provide any records of wintering birds in their consultation correspondence. Consultation with the Royal Society for the Protection of Birds (RSPB) confirmed that there are no RSPB nature reserves within or adjacent to the proposed scheme study area.

40.3.161 Previous records of key wintering bird species and assemblages within the route corridor were obtained from the BTO and WWT in 2005.

40.3.162 The North-East Scotland Bird Report (2005) was consulted with regard to the wintering species found within the route corridor.

Field Survey

40.3.163 These data are presented in (Figures 40.6a-f) and account for approximately 19% of the total study area.

40.3.164 Eight Quadrats were also surveyed:

- Quadrat FL-Wb01 Stonehaven Junction (F1, F2, F3 and F4);
- Quadrat FL-Wb02 South of Coneyhatch (F6, F7 and F8);
- Quadrat FL-Wb03 West of Cantlayhills (F8, F11 and F12);

- Quadrat FL-Wb04 Northwest of Burnside (FL13, F15 and F16);
- Quadrat FL-Wb05 Cookney (F16, F17, F18 and F19);
- Quadrat FL-Wb06 South of North Rothnick (F18);
- Quadrat FL-Wb07 Stranog Hill (F21, F22 and F23); and
- Quadrat FL-Wb08 Blaikiewell (F26).

40.3.165 All eight Quadrats were subject to five wintering bird surveys and account for an equivalent of approximately 20% of the survey corridor area.

40.3.166 Thirty-three key bird species were recorded throughout the study area (refer to Table 40.12). Two of the species have WCA1i status (fieldfare and redwing) and were recorded throughout the study area. Eleven were JNCC Red List species skylark (*Alauda arvensis*), bullfinch (*Pyrrhula pyrrhula*), song thrush *(Turdus philomelos*), starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), tree sparrow (*Passer montanus*), yellowhammer (*Emberiza citronella*), reed bunting (*Emberiza schoeniclus*), grey partridge (*Perdix perdix*), linnet (*Carduelis cannabina*) and willow tit (*Parus montanus*), and 20 were JNCC Amber List status including curlew (*Numenius arquata*) and lapwing (*Vanellus vanellus*), which also have local BAP status.

Table 40.12 – Records of Key Bird Species (ordered by status)

Species	Scientific Name	Status	Location/Description
redwing	*Turdus iliacus*	WCA1i, JNCC Amber List	Groups recorded flying around Stranog Hill and Blaikiewell.
fieldfare	*Turdus pilaris*	WCA1i, JNCC Amber List	Recorded in throughout the survey corridor on a number of occasions.
grey partridge	*Perdix perdix*	JNCC Red list, UK BAP and LBAP	Recorded in throughout the survey corridor on a number of occasions.
linnet	*Carduelis cannabina*	JNCC Red list, UK BAP	Recorded in throughout the survey corridor on a number of occasions.
reed bunting	*Emberiza schoeniclus*	JNCC Red list, UK BAP	Recorded in throughout the survey corridor on a number of occasions.
skylark	*Alauda arvensis*	JNCC Red list, UK BAP	Recorded in throughout the survey corridor on a number of occasions.
tree sparrow	*Passer montanus*	JNCC Red list, UK BAP	Recorded in flight Northwest of Burnside.
song thrush	*Turdus philomelos*	JNCC Red list, UK BAP	Recorded in throughout the survey corridor on a number of occasions.
bullfinch	*Pyrrhula pyrrhula*	JNCC Red list, UK BAP	Recorded flying West of Cantlayhills and near Blaikiewell.
yellowhammer	*Emberiza citrinella*	JNCC Red list	Recorded in throughout the survey corridor on a number of occasions.
willow tit	*Parus montanus*	JNCC Red list	Recorded south of Coneyhatch.
house sparrow	*Passer domesticus*	JNCC Red list	Recorded in throughout the survey corridor on a number of occasions.
starling	*Sturnus vulgaris*	JNCC Red list	Recorded in throughout the survey corridor on a number of occasions.
cormorant	*Phalocrocorax carbo*	JNCC Amber list, UK BAP	Recorded flying near Stranog Hill.
kestrel	*Falco tinnunculus*	JNCC Amber list, LBAP	Recorded hunting near Burnside and Stranog Hill.
curlew	*Numenius arquata*	JNCC Amber list, LBAP	Recorded in throughout the survey corridor on a number of occasions.
snipe	*Gallinago gallinago*	JNCC Amber list, LBAP	Recorded in throughout the survey corridor on a number of occasions.
green woodpecker	*Picus viridis*	JNCC Amber list	Recorded south of Coneyhatch.
lesser redpoll	*Carduelis cabaret*	JNCC Amber list	Recorded west of Cantlayhills.

Species	Scientific Name	Status	Location/Description
stock dove	*Columba oenas*	JNCC Amber list	Recorded near Cookney
goldcrest	*Regulus regulus*	JNCC Amber list	Recorded in throughout the survey corridor on a number of occasions.
greylag goose	*Anser anser*	JNCC Amber list	Recorded South of North Rothnick and near Blaikiewell.
pink-footed goose	*Anser brachyrhynchus*	JNCC Amber list	Recorded in throughout the survey corridor on a number of occasions.
dunnock	*Prunella modularis*	JNCC Amber list	Recorded in throughout the survey corridor on a number of occasions.
meadow pipit	*Anthus pratensis*	JNCC Amber list	Recorded in throughout the survey corridor on a number of occasions.
mute swan	*Cygnus olor*	JNCC Amber list	Recorded near Burnside.
herring gull	*Larus argentatus*	JNCC Amber list	Recorded in throughout the survey corridor on a number of occasions.
common gull	*Larus canus*	JNCC Amber list	Recorded in throughout the survey corridor on a number of occasions.
black-headed gull	*Larus ridibundus*	JNCC Amber list	Recorded in throughout the survey corridor on a number of occasions.
oystercatcher	*Haematopus ostralegus*	JNCC Amber list	Recorded at Stonehaven Junction and near Stranog Hill.
woodcock	*Scolopax rusticola*	JNCC Amber list	Recorded near Coneyhatch and West of Cantlayhills.
mistle thrush	*Turdus viscivorus*	JNCC Amber list	Recorded in throughout the survey corridor on a number of occasions.

40.3.167 Quadrat 8 near Blaikiewell was the most important Quadrat for wintering birds supporting 33 species, including one WCA1i species (redwing), together with six JNCC Red List and 11 Amber List species. Quadrat 5 in Cookney was the second most important Quadrat within the route corridor for wintering bird assemblages supporting 26 wintering bird species including one WCA1i species (fieldfare), seven JNCC Red List and seven Amber List species. Good numbers of the WCA1i species (redwing and fieldfare) were recorded in Quadrat 7-Stranog Hill. Moderate assemblages of key species were recorded in Quadrat 3-Cantlayhills and Quadrat 4 supporting four and six JNCC Red List species respectively and each supporting seven Amber List species. Quadrat 2-South of Coneyhatch was the least important Quadrat supporting 25 wintering bird species of which one species was JNCC Red List and seven were Amber List.

Overall Summary of Baseline Conditions

40.3.168 In the predominantly agricultural habitat present within the study corridor, there is a relatively small amount of semi-natural habitat. Coniferous plantation woodland is the dominant land use after agriculture, with areas of mixed plantation and scrub recorded frequently. There are small patches of semi-natural and wet woodland (NES LBAP Habitat) generally dominated by birch and rowan; the majority of this habitat is focussed around the Fishermyre area. There is one area of semi-natural broad-leaved woodland, Slicewells Wood (F5), which is on the AWI.

40.3.169 This largely agricultural landscape supports a wide range of species. Badgers are present in lower numbers than in the Northern Leg, due to lack of suitable setting habitat (too wet for tunnelling) and poor foraging – although they are still common and widespread throughout the Fastlink study area, with Limpet Burn and Stranog Hill offering both alternative setting and foraging habitat. Bats are present throughout the study area with roosts and commuting routes located in close proximity to the route. Megray Burn, the Burn of Muchalls, Crynoch Burn and Cookney and surrounds are core areas for a number of species.

40.3.170 Otter activity is generally concentrated along the Limpet Burn, Burn of Muchalls, Back Burn and the Burn of Elsick, providing well-used commuting routes and prey. Red squirrels are not present in the study corridor, although they have been sighted in woodland just outside the corridor, in a strip

of broad-leaved woodland approximately 50m west of Megray Wood. Megray wood may therefore be used as an occasional refuge.

40.3.171 During the breeding bird surveys, 27 key bird species were recorded throughout the Fastlink study area. Six of of the key species recorded were of JNCC Red List/UK BAP status, four were of Red List only status and 16 were JNCC Amber List status including curlew and lapwing, which additionally have local BAP status. With respect to the wintering bird surveys, 33 key bird species were recorded throughout the Fastlink study area. Seven of the key species recorded were of JNCC Red List/UK BAP status, 11 were of Red List only status and 20 were JNCC Amber List status including curlew, kestrel and snipe, which additionally have local BAP status.

40.3.172 Frogs, toads and palmate newts were assumed (40.2.56) to be present throughout the study area in close proximity to areas of standing water such as Fishermyre Pond (outside the study area) and Elsick Ponds. One incidental sighting of a common lizard basking next to a log pile was made in Section FL1 of the Fastlink study area, within the vicinity of Limpet Burn – and there were areas of general suitability, particularly around Limpet Burn and Fishermyre. Incidental sightings of the generally nocturnal brown hare were not abundant, with the exception of agricultural fields surrounding Cookney (F18) that also had particularly suitable habitat. A small population of water vole was present in the area of Fishermyre; there is potential for this population to spread to other wetland areas within the corridor. Mosaic habitats are of greatest potential for terrestrial invertebrate populations. There are suitable areas throughout the Fastlink study area.

40.3.173 Freshwater macroinvertebrate sampling, combined with River Habitat Survey, highlighted the following burns as being of particular ecological value: Limpet Burn. Freshwater macroinvertebrate sampling, combined with River Habitat Survey, highlighted Limpet Burn, Back Burn and Burn of Muchalls as being of particular ecological value).

40.3.174 Overall, the baseline data for habitats and species has highlighted that Limpet Burn, The Burn of Muchalls, Stranog Hill, Crynoch Burn and Fishermyre are key areas for biodiversity in the region.

40.4 Evaluation of Baseline Conditions

40.4.1 The ecological value of the baseline conditions for the study area has been evaluated in accordance with the methods described in Section 40.2 and the geographical framework detailed in Table 40.5. This section summarises the ecological value of terrestrial and freshwater habitats and local species populations found in the study area.

40.4.2 A description of each Habitat Area is presented with their respective evaluations. The most significant Habitat Areas for each habitat and species are discussed and reported in the summary Table 40.16. For those receptors with full details provided in Appendices A40.2 to A40.9, the summary table presents only those areas of county importance or above. For those receptors without appendices, evaluations are presented in full.

Terrestrial Habitats

Section FL1

40.4.3 In this section, five Habitat Areas have been assessed as being of regional importance, covering two ecologically and geographically linked areas. Fishermyre Wood (F5, F10, F11 and F12) is noted for its variety of wet habitats, including wet woodland, fen and heath.

40.4.4 Megray Wood (F6) is assessed as being of county value due to it containing a viable area of LHAP habitats: plantation woodland and burn. However, this Habitat Area has been upgraded to regional value due to its close proximity and connectivity with Limpet Burn (F7), which contains both willow and birch UK BAP wet woodland.

Section FL2

40.4.5 The Burn of Muchalls fulfils the criteria for the LHAP Burns and Rivers, while the wet woodland located along the flood plain is a UK BAP priority habitat. This watercourse extends outside of Habitat Area F15, and contributes to riparian and wetland habitats outside the study area, and thus is of county value.

Section FL3

40.4.6 There are five Habitat Areas of county value in this section (F17, F19, F21, F23, F24), which have been assessed on the basis that they contain the UK BAP priority habitats of lowland raised bog, lowland heathland or willow carr. However, their modified and fragmented nature lead to these areas being downgraded in value.

40.4.7 Crynoch Burn (F27) has similar riparian habitats as stated above. Although it is part of the River Dee SAC, this designation relates to fauna. As the designation does not relate to terrestrial riparian habitats specifically, this Habitat Area is assigned as being of regional value.

Badger

40.4.8 Badgers are common and widespread throughout the British Isles and to a lesser extent in Europe. However they are a nationally protected species in terms of legislation and recently have been included on the 'Scottish Biodiversity List' under the Nature Conservation (Scotland) Act 2004 as a species considered to be of principal importance for the purpose of biodiversity conservation in Scotland. The potential impact of road schemes on badgers in terms of mortality, displacement, severance, habitat fragmentation and foraging habitat loss, could be considered a breach of current legislation, which makes it an offence to kill or injure badgers or interfere with their setts.

40.4.9 Therefore, for animal welfare and conservation reasons and to minimise such offences, badgers are considered to be a nationally important species. Habitats of good or moderate quality that support badger populations, as identified by social groups and described in Appendix A25.2, but are not essential to maintain the populations, are evaluated as being of county ecological value. Those vital for maintenance of the local population are evaluated as being of regional value.

40.4.10 The following paragraphs contain a summary of the information reported for badger populations and their habitat. Full details are provided in Appendix A40.2 (Badger Report – Confidential).

Section FL1

40.4.11 Badger habitats are of low to moderate quality with one Social Group (Group B) resident within the survey corridor and another Social Group (Group A) utilising the area for foraging. These social groups occupy large territories, but nevertheless still exhibit some degree of territorial defence.

40.4.12 It is unlikely that further social groups could be supported in this area due to the limited available sett building habitat and sub-optimal foraging habitat, except in Limpet Wood. The other areas of woodland that are present are generally very dense, poorly-drained coniferous plantations such as Fishermyre Woods. Consequently, badgers must make use of other habitat types in which to construct their setts, e.g. gorse. This lack of cover means that there is little connectivity between habitats.

40.4.13 While pasture fields are abundant, the soils in the area are likely to be thin and therefore only moderately productive in terms of earthworms. Alternative foraging habitat is offered by scrub and arable land, although these areas are unlikely to be very productive.

40.4.14 The A90 acts as a barrier to limit the extent of potential badger territories, increasing the risk of RTAs and limiting badger movements into or out of the south and east of this area. This section is therefore evaluated as being of county ecological importance.

Section FL2

40.4.15 In this section of the route, habitats of low quality support badger populations, with one Social Group (Group D) resident within the survey corridor and two Social Groups (Group C and an un-identified group to the northwest of Fishermyre Moss) that utilise the areas for foraging.

40.4.16 This section offers a limited amount of suitable setting habitat with no woodland cover. Consequently, badgers in this section must make use of other habitat types in which to construct their setts. For instance, Group D's main sett is located in willow carr scrub, which offers sub-optimal setting habitat. As a result of this lack of cover, the section offers low levels of connectivity.

40.4.17 As described for the previous route section, although pasture fields are abundant, the soils in the area are likely to be thin and therefore only moderately productive in terms of earthworms. Alternative foraging habitat is offered by scrub and arable land although these areas are unlikely to be very productive.

40.4.18 These social groups occupy large territories that are widely separated from one another. It is unlikely that further social groups could be supported in this area. This section is therefore evaluated as being of county ecological importance

Section FL3

40.4.19 Badger habitats are of low to moderate quality in this section, with one Social Group (Group E) resident within the survey corridor while another two groups (Group F and G) utilising the area for foraging.

40.4.20 A limited amount of suitable setting habitat is available with only one woodland present (East Crossley Wood). Consequently, badgers in this section must make use of other habitat types in which to construct their setts, e.g. gorse. There are few suitable habitat features such as tree lines present for commuting.

40.4.21 As in the two previous route sections, the foraging habitat is generally of poor value and only of county ecological importance.

40.4.22 Although badgers were recorded throughout the study area, they occur in relatively low density due to poor setting and foraging habitat. Consequently, the study area is principally only used by three badger Social Groups (Groups E, F and G) and is likely to be of minimal importance to social groups outside of the study area.

Bats

40.4.23 All species of bat are European protected species, protected by legislation set out in the EU Habitats Directive and transposed into UK law by the Conservation Regulations (1994). Pipistrelle bats are priority species in the UK BAP and Daubenton's bats are included in the NES LBAP.

40.4.24 As an internationally important group of species, the sites necessary to maintain the viability of populations in the Aberdeen area (such as roost sites) are evaluated as being of regional importance to nature conservation. Sites deemed to be supporting bat populations, such as important foraging habitat or commuting corridors, are evaluated as being of county importance. Sites with potential to support bat populations considered to appreciably enrich the habitat resource within the local context are evaluated as being of local importance.

40.4.25 The following paragraphs contain a summary of the evaluation of ecological importance of the Habitat Areas within each route section for bat populations and their habitats descriptions of which are presented in Table 40.16 for areas of county or higher importance. For full details refer to Appendix 40.3.

Section FL1

40.4.26 Of the 11 Habitat Areas identified, one has been evaluated at less than local, nine of county and one of regional importance to bats in F3 (Megray Burn). The burn is a commuting route for pipistrelle bats. Roosts identified at New Mains of Ury Farmhouse and Farm, Megray Farm Steading and Forester's Croft also lie within this Habitat Area. An existing culvert across Megray Burn also provides potential roost opportunities. The relatively high proportion of Habitat Areas of county importance is a reflection on the fact that bats were observed using many of the features during surveys, including shelter belts, woodland and waterbodies. These features, which intrinsically support local populations of bats, are small and fragmented. However, they are widespread and considered to be of wider importance to bats roosting throughout the route section. The presence of a number of small roosts for pipistrelle is important in maintaining bat populations and reflects the regional importance of these features to bats. The size of the roosts would not be considered as being of national importance for the species identified.

Section FL2

40.4.27 Of the five Habitat Areas identified, one has been evaluated at local, one of county and three of regional importance to bats. Building roosts are present in Woodview (F13), two building roots in F15 (Burnorrachie Croft and Burnside) and six roosts including a culvert between the Burn of Muchalls and Cookney (F16) – maintaining small populations of internationally important species including soprano pipistrelles and Daubenton's bats, which are not threatened or rare in the region or county. Evening emergence surveys need to be completed to confirm that no other potentially rarer species are present. The Burn of Muchalls in particular provides a high value habitat, which is likely to support bats roosting in the area.

Section FL3

40.4.28 Of the 11 Habitat Areas identified, three are considered to be of local importance, three of county importance and five of regional importance. A roost in a barn associated with Cookney Grange and another in a barn at Hillend (F17), one at North Cookney Croft (F18), two roosts at Crossley and Crossley Farm Steading (F21), Altries Manse (F22) and a barn at Greens of Crynoch (F26). The relatively high proportion of habitat areas of county importance is a reflection on the fact that bats were observed using many of the features within this section including shelter belts, woodland and water features. Such features, which intrinsically support local populations of bats, are small and fragmented but widespread and considered to be of wider importance to bats roosting.

Breeding Birds

40.4.29 The ecological value of each SOV and Quadrat for breeding birds was determined by considering the evaluation of its habitat potential for breeding birds (derived from information in Appendix A40.1 Terrestrial Habitats) combined with the value of the breeding bird assemblage present as recorded (refer to Appendix A40.4).

40.4.30 An assessment was then made of the representativeness of the habitats found in each Quadrat or SOV in relation to the non-surveyed areas adjacent. The ecological value of the remaining Habitat Areas in each route section was then determined by an initial evaluation of their habitat potential for breeding birds combined with the knowledge of the breeding bird assemblages found in adjacent representative Quadrats or SOVs.

40.4.31 All Quadrats were determined to be sufficient for the evaluation of breeding bird assemblages with the exception of Quadrat SLQ7: Crossley due to its lack of representative bird habitat.

40.4.32 The following summary presents an evaluation of habitats and breeding bird populations according to SOVs and Quadrats for each route section in the study area (full details are presented in Table 17 Appendix A40.4).

Section FL1

40.4.33 Three SOVs (Limpet Burn, Kempstone Hill and South Fishermyre) and two Quadrats (Stonehaven and Megray) were identified. Habitats within Limpet Burn comprise a high value mosaic of dense marsh with scattered willow, birch woodland, dense bracken and continuous gorse scrub and is assessed as being of county value. Kempstone Hill comprises a medium value mosaic of gorse scrub-acid grassland with some dry heath vegetation and is evaluated as being of local value. South Fishermyre comprises a medium value mosaic of gorse scrub-acid grassland with some dry heath vegetation and is assessed as being of county value.

40.4.34 Quadrat SLQ1 (Stonehaven) comprises arable and improved fields with areas of scattered scrub and parkland/scattered trees with areas of broad-leaved woodland. Megray Burn bisects the Quadrat south of H Ram Wood. Quadrat SLQ2 (Megray) comprises mature coniferous plantation woodland and arable fields bordered by native species-rich hedgerows with pockets of scattered and dense scrub. Habitats within both Quadrats were assessed as being of low value for breeding birds, and these areas are assessed as being of less than local value.

40.4.35 Habitat Area F11, Fishermyre Wood West, is a mix of medium value habitats for breeding birds, with semi-natural broadleaved birch wood towards the edge with the B977 combined with dense continuous gorse scrub. Behind the birch wood is a Scots pine conifer plantation, with acid grassland underneath and beyond. The hill to the north is composed of semi-improved neutral grassland. It is representative of Fishermyre SOV and has been assessed as being of county value.

Section FL2

40.4.36 Habitats within North Fishermyre SOV comprise a high value mosaic of dry heath, with dense gorse scrub and mixed semi-natural woodland. Scattered pockets of willow dominated wet woodland are also present. The SOV is evaluated as being of county value.

40.4.37 Quadrat SLQ3 (Howieshill) comprises fields of arable and improved grassland with native species-rich hedgerows and scrub, which are evaluated for breeding birds as being of low value and is assessed to be of less than local value. Quadrat SLQ4 (Burn of Muchalls) comprises a mosaic of semi-natural wet woodland, young mixed plantation woodland and naturalised plantation mixed woodland with species rich hedgerows and areas of marsh/marshy grassland of medium value for breeding birds and is is assessed to be of county value.

40.4.38 Habitat Areas F15 and F16 were partially covered by the Burn of Muchalls SOV and were representative of Quadrat FL-Bb05. These areas of riparian habitat and hedgerow and scrub rich agricultural land are assessed to be of county value.

Section FL3

40.4.39 Two SOVs (Cookney and Harecraig) and four Quadrats – SLQ5 (Burnhead) SLQ6 (Balnagubs) SLQ7 (Crossley,) and SLQ8 (Polston) – are located within Section FL3. Habitats within Cookney comprise a large mosaic of marsh/marshy grassland with areas of patchy gorse scrub and large stands of willow carr woodland and is assessed as being of medium value to breeding birds, in terms of its habitats and of county value. Harecraig comprises a mosaic of patchy alder, willow and birch scrub/woodland on an area of marsh/marshy grassland with patches of wet heath vegetation and gorse scrub of high value and is assessed as being of county value.

40.4.40 The areas within the Quadrats comprise a range of habitats, including agricultural land with patches of gorse scrub along boundary features, broad-leaved and coniferous plantation woodland and scattered trees areas of marshy grassland and wet heath and bog. Red Moss of Netherley SAC comprises part of Quadrat SLQ5. These are assessed as being of medium value for breeding birds with the exception of Quadrat SLQ5, which is considered to be of high value. All Quadrats are assessed as being of county ecological value in terms of their habitat and breeding bird assemblages.

40.4.41 Habitat Areas between Cookney and Stranog Hill in this section are largely agricultural but support interspersed mosaics of semi-natural habitats that are of medium and high value to breeding birds. These areas range from dry heath acid grassland mosaic dominated by wavy-hair grass and ericoids, plus cotton grasses to marshy grassland and wet woodland dominated by willow. There are small patches of wet modified bog and scattered scrub throughout. These areas are partially sampled by Harecraig and Cookney SOV and Quadrats SLBb05 and SLBb06. Habitat Areas, F17, 18,19,21,22,23,24 and 25 are therefore of county value.

Otter

40.4.42 The otter is a species of international conservation importance due to its inclusion in Annex IV and Annex II of the Habitats Directive. It is also a priority species in the UK BAP. However, the otter is not threatened or rare in the region or county, and is not an NES LBAP priority species. Aberdeen is known to be an important area supporting internationally important populations of otters in the Dee and Don catchments, therefore local otter populations are assessed as being of national conservation importance. The identification of otter signs, their resting places and otters themselves along many of the watercourses within the study area reflects this assessment.

40.4.43 Habitats that support a viable local population of otter are evaluated as being of county ecological value, and habitats vital to maintain a local population are assessed as being of regional ecological value. The following paragraphs contain a summary of the information reported for otter, for full details of which are provided in Appendix A40.5 (Otter Report).

Section FL1

40.4.44 Megray Burn provides medium value foraging habitat and shelter. The burn is located close to high value riparian habitat at Limpet Burn, which provides a reliable supply of fish, abundant lying up opportunities and is used extensively by otters. Although no otter signs were found at Coneyhatch Burn, it provides a commuting route through Megray Wood. Coneyhatch Burn is strategically placed between Limpet Burn, secluded scrub at Fishermyre and the Burn of Muchalls via Green Burn, which all displayed signs of otter use.

40.4.45 Fishermyre Pond provides a reliable source of fish and excellent lying up opportunities. The features in this section are likely to be exploited by the otter population including breeding otters, which use the Burn of Muchalls.

40.4.46 Limpet Burn is assessed as being of regional importance as it is central to the otter habitat in this section. The rest of the waterbodies described in this summary are of county importance as they are integral to supporting this community, providing connectivity to the resources offered by Limpet Burn.

Section FL2

40.4.47 The presence of a couch, potential couch sites, abundant other field signs and a sighting by a local landowner indicates frequent use of Back Burn by otters. Juvenile prints indicate the presence of breeding otters along the burn. This watercourse acts as a commuting route between the Burn of Muchalls and features to the west, including Fishermyre Pond. The Burn of Muchalls flows into the sea, providing connectivity with the coastal resource. Several of the other watercourses within the study area are also tributaries of the burn.

40.4.48 The Burn of Muchalls is assessed as being of national ecological importance due to its high value habitat, connectivity and the presence of breeding otters. Back Burn is of regional importance as it maintains this community in this area.

Section FL3

40.4.49 The Burn of Blackbutts is located close to the Burn of Muchalls, providing lying up opportunities and secluded foraging habitat. The Burn of Blackbutts also flows directly into the sea, which provides otters with connectivity to coastal resources. Balnagubs Burn forms part of the drainage channel network used extensively by otters at the Burn of Elsick where three couches and many potential lying up sites were identified. Crossley Burn provides a potential commuting route from this resource toward Crossley Pond, which is a reliable source of fish prey within commuting distance of Crynoch Burn and the SAC.

40.4.50 A core area of otter foraging, commuting and lying up has been identified at the Burn of Elsick, which is evaluated as being of regional importance. The rest of the waterbodies in this section are considered to be of county importance as they are integral to supporting this community resource for otters.

Red Squirrel

40.4.51 Aberdeen is on the edge of the current northern distribution of the grey squirrel, which competes with the red squirrel where the two occur together. Red squirrel is considered to be a species of national conservation concern and is threatened throughout Scotland. Habitats supporting populations of red squirrels in the Aberdeen area are therefore assessed as being of regional ecological value as these are regularly occurring, locally significant populations of a species that occurs in a regional and UK BAP.

40.4.52 Habitats maintaining locally significant populations are evaluated as being of national importance. Habitats not currently supporting red squirrel, but considered to appreciably enrich the habitat resource within the local context are evaluated as being of local importance. The following paragraphs contain a summary of the information reported for red squirrel, for full details refer to Appendix A40.6.

40.4.53 Two areas of woodland have been identified as being of habitat value to red squirrels. These are Megray Wood (F6) and Craigentath Wood, which is located outside of the study area (FL Woodland 6, Table 7, Red Squirrel Report Appendix A40.6).

40.4.54 Although a red squirrel was sighted approximately 50m from Megray Wood, in neighbouring broad-leaved woodland on the edge of the survey area, hair-tube and visual surveys within Megray Wood did not reveal any evidence of red squirrel presence. It is possible that red squirrels are crossing the B979 and utilising Megray Wood, but this behaviour was undetected by the surveys. Red squirrel home ranges are considered to vary between 1.5ha (Wauters and Dhondt 1987) and 13.4ha (Corbett and Southern, 1977) and Megray Wood may fall within the squirrel's home range.

40.4.55 Megray Wood is dominated by Sitka spruce that is thought to provide poor foraging habitat for red squirrels due to its unpredictable coning cycle. The trees in Megray Wood are more than 30 years old (land owner personal communication) and so are mature enough to produce mast. However, due to its dominance by just one species, this plantation is unlikely to provide a year-round food resource for red squirrels, as even aged plantations dominated by Sitka spruce are considered to only support low densities of red squirrels. It is perhaps more probable that red squirrels are using Megray Wood intermittently (if at all) and are commuting into the study area along Cowie Water from Fettereso Forest to the west (outside the study area). Fettereso Forest (NO 790870) is an expansive area of coniferous forest, which is known to maintain a significant red squirrel population (Forestry Commission website). In light of this, Megray Wood is considered to be of county importance for red squirrels.

40.4.56 No red squirrels were recorded in woodland elsewhere within the survey area: Limpet Burn Wood, Fishermyre Wood, North Fishermyre Wood (all Section FL1) or East Crossley Wood (Section FL3, F24). These woodland habitats are dominated by broad-leaved species and/or are considered to be of limited value to red squirrels. Limpet Burn Wood is predominantly comprised of birch and

although red squirrels are known to feed on birch-mast, the dominance by this deciduous species means it is unlikely that this area of woodland can provide red squirrels with a reliable year-round food supply. East Crossley Wood, Fishermyre Wood and North Fishermyre Wood are all, predominantly, made up of immature trees and while there are some stands of mature Scots pine present at East Crossley Wood and Fishermyre Wood, it is not considered a sufficient amount to provide suitable cover and year-round foraging opportunities for red squirrels. Therefore, these woodland areas are considered to be of less than local importance.

40.4.57 Although no red squirrels were recorded in Craigentath Wood (outside the survey area), feeding signs were observed throughout the woodland indicating that red and/or grey squirrels are present. The woodland habitat is of high value to red squirrels comprising mature coniferous species such as Scots Pine and Sitka spruce and thus providing refuge and foraging opportunities for red squirrels. Craigentath Wood is therefore considered to have high potential for supporting a red squirrel population and as such is deemed to be of county importance.

Water Vole

40.4.58 Due to their national decline, water vole is a species of national conservation concern. A population was discovered during surveys in Section FL1, where previously water vole were thought to be extinct in Aberdeenshire. The water vole population identified within the study area has therefore been evaluated as being of national ecological importance in this area. It is also recognised that there is potential for water vole to recolonise any suitable habitat within dispersal distance of the present population. Each waterbody has also been evaluated in terms of its importance to water voles based on presence of water voles, habitat quality and distance from extant water vole populations. Habitat that maintains a viable water vole population is evaluated as being of national ecological importance and habitats in close proximity with good potential for water voles are assessed as being of regional ecological importance. Full details of individual waterbodies are evaluated and presented in Appendix A40.7 (Water Vole Report).

Section FL1

40.4.59 Water vole colonies have been identified on the following high quality waterbodies, Green Burn and (WB5) the drain at Fishermyre Moss (WB6) Fishermyre Moss (WB7) and Fishermyre Pond (WB8). These have been evaluated as being of national importance. Each of these waterbodies is likely to be essential to the viability of the Fishermyre water vole population as a whole.

40.4.60 In addition to potentially supporting several water vole colonies, Fishermyre wetland provides alternative foraging habitat and nesting habitat to that offered by the drainage ditches and provides a linkage between the water vole colonies identified throughout the area. This allows water voles to disperse and colonise new areas and allows genetic exchange making this site fundamental to the survival of this small, fragmented population.

40.4.61 Coneyhatch Burn and associated ditches (WB4) presented no evidence of water voles at the time of survey. However, a large section of the associated drainage ditches offer habitat of high quality, less than 500m from an existing water vole colony with a large degree of connectivity. These drainage ditches may provide a wildlife corridor along which water voles can disperse. Given that there are frequent fluctuations in suitable site occupancy associated with the natural dynamics of water vole metapopulations, there is a significant probability that this site has previously supported water voles and could again in the near future. It may offer an important habitat resource to the wider Fishermyre water vole metapopulation and has been evaluated as being of county importance.

40.4.62 Waterbodies associated with Limpet Burn and Megray Burn (WB1 to WB3) have no water voles resident although they do offer suitable habitat and are well linked and close to the population at Fishermyre. Therefore, there is the possibility that these waterbodies could become colonised in the future and they are evaluated as being of local importance to water voles.

Section FL2

40.4.63 No water voles were recorded on Allochie Burn and Back Burn (WB9 and 10), although they offer some suitable habitat and are well linked and close to the population at Fishermyre. Therefore, there is the possibility that these water bodies could become colonised in the future and they are evaluated as being of local importance to water voles.

40.4.64 Water voles were absent from Burn of Muchalls and associated ditches and Burn of Blackbutts (WB11and12). These waterbodies, although offering some suitable habitat and being moderately close to the Fishermyre population (approximately 2km away), are isolated from the Fishermyre population by intensive farmland and roads. It is considered unlikely that these waterbodies would be colonised by water voles in the future and they have been evaluated as being of less than local importance for water voles.

Section FL3

40.4.65 Water voles were absent from Cookney Ditch, Stoneyhill Burn, East Burn, Whiteside Burn and Crossley Burn (with associated Burns) (WB13 to WB18). Although offering some suitable habitat and being moderately close to the Fishermyre population (between 2km and 6km away), these watercourses are isolated from the Fishermyre population by intensive farmland and roads. Therefore, it is considered unlikely that these waterbodies will be colonised by water voles in the future and they are evaluated as being of less than local importance for water voles.

40.4.66 Water voles were not found in Stranog Burn, Greens of Crynoch (with associated burns) and Crynoch Burn (WB19 to WB21). These watercourses are distant (more than 7km) from the nearest known water vole population. They are also severed from the water vole population by intensive agricultural land. Colonisation of these areas using the main arterial watercourses is extremely unlikely as these are all well used by mink. Therefore, they are evaluated as being of no ecological value to water voles.

40.4.67 There is a suite of moderate to good water vole habitat throughout the study area and without mink, water vole would likely colonise the area. SNH are currently piloting a mink eradication program in the Western Isles with a view to protecting breeding birds on the islands (SNH, 2003). Although the trapping scheme is progressing well it is expensive and labour intensive. Whilst mink eradication on an island system is viable it is likely to be much more difficult to achieve on the mainland as mink would be able to recruit from the wider population unless trapping was undertaken on a massive scale. Given the logistical problems associated with a mainland mink eradication it is unlikely to happen in the near future.

Water Shrew

40.4.68 The habitat evaluation for water shrews was based on the vegetation suitability of a given watercourse and the level of aquatic invertebrates in the water taken from the Freshwater Ecology Report (refer to Appendix A40.9). Details of the channel and bank vegetation were taken from the Water Vole report (Appendix A40.7) and together give an indication of water quality and habitat suitability.

40.4.69 It is assumed that each of the nine identified water features and adjacent terrestrial Habitat Areas could potentially support populations of water shrew and therefore are evaluated as being of local importance to water shrews.

Section FL1

40.4.70 Megray Burn, Limpet Burn and Green Burn were identified as providing potential habitat for water shrews. Megray Burn was sampled for invertebrates at an upstream location and a downstream location as the burn changes its characteristics along its course. Both showed the invertebrate assemblage to be good (see Table 40.2). Limpet Burn downstream of the proposed crossing was

not surveyed for invertebrates as the channel was not always distinct and for most of the reach, it seeped through wet grassland in a steep, u-shaped valley.

40.4.71 The bank vegetation suitability (taken from Appendix 40.7: Water Vole) is high for Megray Burn, which means there is suitable cover for water shrews. Limpet Burn downstream was also classed as high whilst upstream where there is some channel modification, the burn was evaluated as being of moderate suitability. Both watercourses provide high overall habitat quality and as such are assessed as being of local ecological importance to water shrews.

40.4.72 Green Burn indicated poor invertebrate assemblage, but high vegetation suitability and had an overall habitat quality of medium (see Table 40.2). It is therefore assessed as being of less than local ecological importance to water shrew.

Section FL2

40.4.73 Allochie Burn, Back Burn and the Burn of Muchalls were all identified as potential water shrew habitats as they are of good ecological quality (based on the invertebrate assemblages, see Table 40.2), which shows that the water quality is high. Back Burn was found to be of excellent ecological condition. The bank vegetation along Allochie Burn was variable with sections that were heavily poached by cattle and so unsuitable for water shrews. Patches of good habitat existed amongst the low quality areas. The overall assessment for Allochie Burn is of medium habitat quality. The vegetation suitability on Back Burn was moderate and high on the Burn of Muchalls (see Table 40.2). The Burn of Muchalls is surrounded by extensive riparian habitat that could be used as an alternative foraging resource and a dispersal corridor. Both burns had an overall assessment of habitat quality that was high. These watercourses are considered of local ecological value for water shrews.

Section FL3

40.4.74 The Burn of Elsick and Whiteside Burn were found to be in good ecological condition based on the invertebrate assemblage, while Crossley Burn was found to be in fair ecological health. The Burn of Elsick had high vegetation suitability, providing cover or refuge and foraging. Whiteside and Crossley Burn had moderate vegetation suitability. Based on this, the overall habitat quality of the Burn of Elsick and Whiteside Burn was high. Due to the fair ecological health of Crossley Burn, the overall habitat quality is medium. All three burns are considered of local ecological importance to water shrews.

Terrestrial Habitat

40.4.75 The value of terrestrial habitat to water shrews is unknown. Water shrews are typically found in habitats around the banks of watercourses but the extent to which they use these terrestrial habitats is not known (Mammal Society, 2004). Therefore, habitat adjacent to watercourses has not been evaluated.

Amphibians

40.4.76 No fully protected amphibian species, such as great crested newt, are known to occur within 50km of Aberdeen. It is therefore assumed that each of the eighteen identified waterbodies and the terrestrial habitat areas could potentially support populations of common frog, common toad and/or palmate newt and are evaluated as being of local importance to amphibians. Waterbodies are evaluated as of county level importance where they are located within 500m of another waterbody. Terrestrial habitat that is considered too small to maintain a viable population and isolated from other areas of habitat is evaluated as less than local importance.

Aquatic Habitat

40.4.77 Standing water is the least common habitat type in the district covering just 37ha (Nature Conservation Strategy for Aberdeen, 1994). Due to the scarcity of standing water within the local

area, the importance of any waterbody considered suitable to support a viable population of amphibians is evaluated as being of local importance. Waterbodies that are in close proximity and are considered to support amphibian populations are considered to be of increased ecological value and are sufficient to enhance the biodiversity resource at the county level.

40.4.78 Fishermyre Ponds in Section FL1 are both considered of local importance. In Section FL2, Elrick Pond Large and Elrick Pond Small are in close proximity, enhancing their ecological value to county importance. In Section FL3, Crossley Pond was identified just within the 500m survey boundary and is considered of local importance.

Terrestrial Habitat

40.4.79 Section FL1 of the Fastlink contains extensive areas of local ecological importance due to the suitable amphibian habitat in F5, F6, F7, F9, and F10, F11 and F12. Each Habitat Area is directly connected to another or within close proximity to another, forming an extensive area throughout which amphibians can live. These areas provide foraging, breeding and dispersing habitat that is condusive to supporting and maintaining viable amphibian populations and as such are assessed as being of local ecological importance. A sighting of a palmate newt within Habitat Area F10 confirms the suitability of the habitat as identified using maps.

40.4.80 In Section FL2, amphibian habitat is found within Habitat Areas F12, F14, F15 and F16. Habitat Areas F14 and F16 provide small isolated fragments of suitable habitat. Based on their size and lack of connectivity they are considered to be of less than local ecological importance. Habitat Areas F15 and F12 have the largest areas of suitable habitat within this section. It consists of hedgerows that facilitate distribution, marshy grassland and forest edges that are good for foraging and shelter. The associated ponds provide suitable breeding habitat for all amphibian species. This Habitat Area is considered to be of local ecological importance, while F14 and F16 are small and isolated so of less than local importance. Habitat Area F12 is continuous with F11 as well as other habitat in Section FL1 and has been evaluated as local importance. F15 provides a range of habitats and features including ponds, which are of benefit to amphibians, are continuous with habitat outside the route corridor and thus are of local ecological importance. These areas provide sufficient habitat to make the section of local importance.

40.4.81 Section FL3 of the proposed Fastlink contains two large Habitat Areas of amphibian habitat within F17 and FL19. They are adjacent to each other so are considered to be of local ecological importance as they form an extensive area of heath, marshy grassland and scrub. Farther north, small isolated fragments of suitable habitat are located within Habitat Area F21. These are of less than local importance. Suitable habitat is found within Habitat Areas F22 and F23, which comprises heath, bog and scrub. It forms a continuous area and so is of local ecological value. Fragments of F22, F23, F24 and F26 form an area of almost continuous habitat that is of local importance. Habitat Aarea F27 is also of local importance because it is continuous with habitat within the Southern Leg section, forming an extensive area of amphibian habitat augmented by such features as ponds and hedgerows.

Brown Hare

40.4.82 Brown hare are a UK BAP and NES LBAP species due to their general decline caused by changes in farming practices and hunting, and are therefore considered to be a species of county ecological value. Any high value habitat that has the potential to support substantial populations has been evaluated as being of county ecological value. Habitat that is of medium or low value, but that has the potential to support a small population, has been assessed as being of local ecological value.

40.4.83 The ecological importance in terms of brown hare populations was determined by combining the evaluations for each of the Habitat Areas and assigning an overall value based on professional judgement combined with habitat evaluations derived from the habitat descriptions.

40.4.84 Within the study area, Section FL2 (F18) provides the greatest diversity of crops and the best potential cover and there were four separate sightings of a total of 12 individuals near Burnside of

Newhall (F18). The small crop fields directly east of Broomhill Farm and extending eastward toward the Burn of Muchalls provide many and varied foraging areas. There is excellent cover in the form of set-aside ground, ditches, field boundaries and dense gorse thickets. Habitat Areas listed in Table 40.13 have been assigned habitat valuations for brown hare.

Table 40.13 – Evaluation of Brown Hare Habitat

Habitat Area (* Brown hare recorded)	Valuation of Habitat	Overall Evaluation
Section FL1		
F3 *	Large arable fields south of Limpet Wood and the Logie Trout Fishery and directly west of Logie Farm provide less than optimal foraging. Good cover within field boundaries, Limpet Wood and dense scrubby gorse.	Medium
F8	Many small crop fields directly east of Broomhill Farm and extending eastward toward the Burn of Muchalls provide many and varied foraging. Excellent cover in set-aside ground, ditches, field boundaries and dense gorse thickets.	Medium
Section FL2		
FL3 *	Mixture of large and small arable fields with also cattle-poached fields between Allochie and Elrick farms with some set aside provide less than optimal foraging. Cover from dense gorse scrub and field boundaries.	Medium
F14 *	Extensive mixture of large and small arable and cattle fields extend from Floors, southward to Elrick, and eastward to just north of Clayfolds and Easterfield, which provide less than optimal foraging. Cover provided by scrubby field boundaries.	Medium
F16 *	Mixture of large arable and cattle fields to the north of West-Town of Newhall extending to Burnside of Newhall provide less than optimal foraging. Cover found along field boundaries.	Medium
Section FL3		
F18 *	Mixture of large pasture fields, scrub and marshy fields to the north of Burnside of Newhall, extending westward to South Rothnick and northward to West Quoscies provide close to optimal foraging. Cover found in gorse boundaries, willow scrub and juncus thickets.	High
F26	Dominated by improved fields, scrub is rare but marshy grassland is present to the west of Burnhead, providing less than optimal cover but suitable foraging potential.	Medium
F27	Mesotrophic semi-improved grassland is dominant to the south, providing suitable foraging, that gives way to improved fields with abundant gorse scrub, providing suitable cover.	Medium

40.4.85 The Habitat Areas identified offer moderate habitat provision for hares, with a mixture of pasture, woodland, dense and scattered scrub, cereals, root crops and set-aside, thereby providing a varied food source. Furthermore, during the summer, long cereals with scrubby boundaries provide good cover for adults and leverets and the pasture areas provide good grazing conditions. In the winter, root crops and winter cereals provide cover and food and the woodlands provide further shelter from severe weather. Throughout the survey area however, many of the fields are large (>2ha) meaning that hares need to move greater distances for food and shelter.

40.4.86 The Habitat Areas above assessed as having medium habitat value are of local importance to brown hare. The rest of those within the study area are considered to be of less than local value with the exception of F18, which has been assessed as being of county value due to the regular presence of brown hare and proximity to optimal habitat.

Reptiles

40.4.87 As mentioned previously, adder, slow-worm and common lizard are not species of conservation concern and receive partial statutory protection. However, due to general decline in suitable reptile habitat, these species are evaluated as being of local ecological value. Although no incidental records of reptiles were made, common lizards, slow-worms and adders are known to be present

near or within the study area. Therefore, it has been assumed that common lizard, slow-worm and adder are present in low frequency and abundance in all suitable habitats within the study area.

40.4.88 Section FL1 of the Fastlink is of local ecological importance due to the reptile habitat in Habitat Areas F5, F6, F7, F9, F10 and.FL11. Each Habitat Area is directly connected to, or within close proximity to, another forming an extensive area throughout which reptiles can live. A sighting of a common lizard within Habitat Area F7 confirms the suitability of the habitat.

40.4.89 In Section FL2, suitable reptile habitat is found within Habitat Areas F12, F14, F15 and F16. Area F14 is a small area of dry heathland that is isolated from other suitable areas. The habitat in area F16 is not as suitable, but still has features like hedgerows and scattered gorse scrub that are important to reptiles. However, the small size and lack of connectivity make these areas of less than local ecological importance. Habitat Area F15 is of local ecological importance for reptiles. It forms quite an extensive corridor of suitable habitat that links up with other habitat outside of the scheme. Features such as species-rich hedgerows, which facilitate distribution, marshy grassland and mixed plantation woodland that provides shelter and foraging opportunities are present. The presence of a series of ponds enhances the habitat by increasing the variety and abundance of invertebrates, which directly benefits the reptiles by increasing the availability and abundance of prey species.

40.4.90 Habitat Areas F15 and F12 have the largest areas of habitat, whilst F14 and F16 are small and isolated, and so of less than local importance. Habitat Area F12 is contiguous with both F11 and other habitat in Section FL1 of the Fastlink study area, and so is of local importance. F15 provides a range of habitats and features of benefit to reptiles, and is continuous with habitat outside the route corridor, so the ecological importance is local. These areas provide sufficient habitat to make the section of local importance.

40.4.91 Section FL3 contains two large areas of reptile habitat within F17 and F19. They are adjacent to each other and form an extensive area of heath and scrub. These are considered to be of local ecological importance. Small isolated fragments of suitable habitat located within Habitat Area F21 are located close to the Burn of Muchalls. These are of less than local importance as they are too small to sustain viable populations of reptiles. Parts of F22, F23 and F24 form an area of almost continuous habitat that is enhanced by Crossley Quarry pond. The habitat comprises dry heath, dense and scattered gorse scrub, and areas of wet bog. This area is of local importance as it represents suitable habitat for reptiles. Habitat Area F27 is of local importance as it is continuous with habitat within the Southern Leg (Appendix A40.1) forming an extensive area of reptile habitat augmented by such features as ponds and hedgerows. The ecological value of this section is of local importance.

Terrestrial Invertebrates

40.4.92 A combination of a literature review and habitat assessment was used to evaluate the potential habitat for terrestrial invertebrates. High value habitat is defined as habitat that potentially supports a wide range of species of national and local conservation concern and has been assessed as being of regional ecological value. Habitat of medium value due to size or likely species composition has been assessed as being of county ecological value. Habitat with low value for terrestrial invertebrates, but enriches the overall biodiversity of the area has been assessed as being of local or less than local ecological value. There are no areas considered as being of greater than local importance form invertebrates in the survey area.

Section FL1

40.4.93 Arable fields dominate the landscape in this section. Some fields in the east contain a diverse ground flora of arable weeds, whilst the fields to the west are shielded by a semi-natural shelter belt. Shrubs occur occasionally across the section. A small plantation is located at H Ram Wood. This area may support one species of local importance.

40.4.94 Megray Wood is a conifer plantation dominated by Scots pine and Sitka spruce. Limpet Burn Wood consists of wet willow and birch woods in the west, giving way to dense gorse scrub and mesotrophic semi-improved grassland, before eventually returning to mixed plantation woodland in the east. This area may support species of local importance.

40.4.95 Fishermyre Wood and its surrounds are composed of a number of wet habitats. Dry heath is probably the most abundant, this being overtaken by fen in the wetter areas. Within the centre and south of the area, a willow carr is succeeding. The east and north are characterised by dense gorse scrub and semi-natural mixed woodland. It has the potential to support a range of Diptera, Lepidoptera and Trichoptera, including two species of national importance and two of local ecological value.

40.4.96 Drains from Fishermye have led to the development of marshy grassland in areas. West Fishermyre Wood is again dominated by wet woodland, although this then gives way to conifer plantation and acid grassland to the west. This area has the potential to support two species of local importance.

Section FL2

40.4.97 Arable fields are the dominant habitat type in this section. Dry stone walls line many of these fields, particularly to the south and east. This area has the potential to support three species of local importance.

40.4.98 The banks of the Burn of Muchalls contain both mixed plantation and more mature semi-natural broadleaved woodland. Additional plantation is located to the north of the Burn, at Elrick Wood. The mature woodlands have the potential to support Lepidoptera plus a range of Coleoptera, Diptera and Isopoda. This habitat has the potential to support three species of local importance.

Section FL3

40.4.99 Agricultural habitats dominate this section with dry stone walls, hedgerows and scrub lining many of the fields. However, this section also contains a significant amount of wetland habitat. Of particular interest are a number of habitats that appeared to be hydrologically linked. An acid grassland/wet heath complex is present within the centre of the section. This has been partly overlain by a new plantation in the north, whilst in the east, this grades into a bog community. The bog becomes more modified farther east, due to laid tracks and planted trees. Towards the south, evidence of hydrological flow can be seen by the occurrence of marsh upon improved fields. Upon levelling, the community succeeds to a dry heath/acid grassland complex. This section has the potential to support Araneae, Coleoptera, Gastropoda, Hymenoptera, Lepidoptera and Molluscs, including seven species of local importance.

40.4.100 The banks of Crynoch Burn are characterised by scattered willow and wet mesotrophic grassland communities. This area has the potential to support Araneae and Coleoptera.

40.4.101 No mature woodland is present within this section, but scrub represents a substantial woody component. This can take the form of field linings; however, much of the scrub is present as dense pockets of gorse, many of which are associated with wetland habitats. Insects attracted to gorse in flower (bees, wasps, flies) may be of interest as well as their predators (spiders, hoverflies, etc.). The habitat may be suitable for one species of local significance (*Lepthyphantes insignis*). Although there are no other locally important species particularly associated with gorse, there may be locally important species using this habitat when in flower.

Table 40.14 – Evaluation of Potential Habitat for Terrestrial Invertebrates

Section/Key Area	Habitats of Use to Invertebrates	General Invertebrate Potential	Locally Importantlinvertebrate Potential	Potentially Supporting Species	Evaluation
Section FL1					
F4	H Ram Wood is a small pocket of mature plantation woodland.	Lepidoptera, Araneae, Diptera	Pyralid moth (*Catoptria permutatella*), robber fly (*Laphria flava*), wolf spider group (*Dipoena torva*)	Three species of local significance	Local
F5	Slicewells Wood is a semi-natural wet birch broad-leaved woodland.	Lepidoptera, Diptera, Gastopoda, Trichoptera	Cousin german moth (*Paradiarsia sobrina*), a cranefly (*Rhabdomastix hilaris*), mountain whorl snail (*Vertigo alpestris*), wall whorl snail (*Vertigo pusilla*).	Four species of local significance	Local
F6	Megray Wood is a mature conifer plantation with a small burn supporting and connecting to a viable area of more species-rich wet woodland.	Lepidoptera, Diptera, Araneae	Pyralid moth (*Catoptria permutatella*), robber fly (*Laphria flava*), wolf spider group (*Dipoena torva*), small pearl-bordered fritillary butterfly (*Boloria selene*), large heath butterfly (*Coenonympha tullia*), a cranefly (*Rhabdomastix hilaris*).	Six species of local significance	Local
F7	There is a mosaic of semi-natural communities along the heavily vegetated Limpet Burn. Communities include a dense marsh with scattered willow carr, wet birch woodland, dense bracken and continuous gorse scrub.	Lepidoptera, Diptera, Gastropoda	Cousin german moth (*Paradiarsia sobrina*), a cranefly (*Rhabdomastix hilaris*), pearl-bordered fritillary butterfly (*Boloria euphrosyne*), mountain whorl snail (*Vertigo alpestris*), wall whorl snail (*Vertigo pusilla*).	One species of national significance and four species of local significance	Local
F11	A mix of semi-natural broadleaved birch wood towards the edge with road, combined with dense continuous gorse scrub. Behind the birch wood is a mature Scots pine conifer plantation, with acid grassland ground flora. The acid grassland extends westwards beyond the plantation. The hill to the north is composed of semi-improved neutral grassland.	Lepidoptera, Diptera, Araneae	A pyralid moth (*Catoptria permutatella*), cousin German moth (*Paradiarsia sobrina*), a hoverfly (*Metasyrphus lapponicus*), a robber fly (*Laphria flava*), a wolf spider group (*Dipoena torva*).	Five species of local significance	Local
F12	The majority of this area is dominated by dry heath. The north and northwest is lined with dense gorse scrub. Mixed semi-natural woodland is present towards the southwest with scattered pockets of willow dominated wet woodland ranging across the south. Fen is present in the environs of the wet woods.	Lepidoptera, Diptera, Gastropoda	Small pearl-bordered fritillary butterfly (*Boloria selene*), large heath butterfly (*Coenonympha tullia*), a cranefly (*Rhabdomastix hilaris*), mountain whorl snail (*Vertigo alpestris*), wall whorl snail (*Vertigo pusilla*).	Five species of local significance	Local
Section FL2					
F15	Riparian habitat surrounds the Burn of Muchalls, including small and localised areas of semi natural wet woodland and young mixed plantation woodland.	Lepidoptera, Diptera, Gastropoda	Cousin german moth (*Paradiarsia sobrina*), a cranefly (*Rhabdomastix hilaris*), mountain whorl snail (*Vertigo alpestris*), wall whorl snail (*Vertigo pusilla*).	Four species of local significance	Local

Section/Key Area	Habitats of Use to Invertebrates	General Invertebrate Potential	Locally Importantlinvertebrate Potential	Potentially Supporting Species	Evaluation
F16	Elrick Wood is a Sitka spruce plantation. The north is mature, whilst the south is relatively recently planted.	Lepidoptera, Araneae, Diptera, Coleoptera, Isopoda	Pyralid moth (*Catoptria permutatella*), robber fly (*Laphria flava*), wolf spider group (*Dipoena torva*).	Three species of local significance	Local
Section FL3					
F17	This is an area with patches of bog and heath, characterised by hare's tail cotton grass humps, and with abundant heather and common cotton grass dominant in the bog pools. The moss species in this area are predominantly *Sphagnum*. There are also areas of wet and dry heath throughout this habitat consisting of heather, cross leaved heath, crowberry, bilberry and occasional purple moor grass. Here *Sphagnum* is not a major constituent.	Lepidoptera, Gastropoda	Large heath butterfly (*Coenonympha tullia*), a pyralid moth (*Catoptria permutatella*), mountain whorl snail (*Vertigo alpestris*), wall whorl snail (*Vertigo pusilla*).	Four species of local significance	Local
F18	Large area of predominantly improved grassland, but also with occasional arable fields. Marshy grassland is present though rare. Scrub is present throughout the habitat, usually scattered around field edges and boundaries. However, dense pockets of continuous gorse scrub are also present.	Araneae, Lepidoptera, Gastropoda	A spider (*Lepthyphantes insignis*), pearl-bordered fritillary butterfly (*Boloria euphrosyne*), mountain whorl snail (*Vertigo alpestris*), wall whorl snail (*Vertigo pusilla*).	One species of national significance and three species of local significance	Local
F19	Marshy grassland dominated by soft rush and grasses. Willow and gorse are frequent throughout the area, both as dense patches and scattered scrub.	Lepidoptera, Gastropoda	Pearl-bordered fritillary butterfly (*Boloria euphrosyne*), mountain whorl snail (*Vertigo alpestris*), wall whorl snail (*Vertigo pusilla*).	One species of national significance and two species of local significance	Local
F20	Series of agricultural fields with occasional pockets of scattered scrub.	Araneae, Lepidoptera	A spider (*Lepthyphantes insignis*), pearl-bordered fritillary butterfly (*Boloria euphrosyne*).	One species of national significance and one species of local significance	Local
F21	Wet habitats around East Crossley that grade from soft rush dominated sheep grazed fields particularly in the north to a more species-rich dry heath/acid grassland mosaic dominated by wavy-hair grass ericoids, and cotton grasses. Scrub is frequent and particularly invasive within the dry habitat.	Lepidoptera, Hymenoptera, Araneae, Gastropoda	Pearl-bordered fritillary butterfly, (*Boloria euphrosyne*), yellow bumble bee (*Bombus distinguendus*), sword-grass moth (*Xylena exsoleta*), a spider (*Lepthyphantes insignis*), mountain whorl snail (*Vertigo alpestris*), wall whorl snail (*Vertigo pusilla*).	Two species of national significance and four species of local significance	Local
F23	Cairns Burn is surrounded by a wet heath acid grassland mix that continues into young plantation in F25.	Araneae	A wolf spider (*Arctosa cinerea*)	One species of local significance	Local
F24	Wet modified bog is the dominant habitat, this being of a higher value in the western section. The eastern section of this area is more modified, containing areas of dry heath, wet birch woods and scattered broadleaves and conifers. A small vegetated burn is present with a pool of standing water.	Lepidoptera, Diptera, Araneae	Small pearl-bordered fritillary, large heath butterfly (*Coenonympha tullia*), pyralid moth (*Catoptria permutatella*), cousin German moth (*Paradiarsia sobrina*), a cranefly (*Rhabdomastix hilaris*), a wolf spider (*Arctosa cinerea*)	Six species of local significance	Local

Section/Key Area	Habitats of Use to Invertebrates	General Invertebrate Potential	Locally Importantlinvertebrate Potential	Potentially Supporting Species	Evaluation
F25	A very young plantation woodland underlain by dry heath/acid grassland mosaic similar to that of F24.	Lepidoptera, Diptera, Araneae	Small pearl-bordered fritillary (*Boloria selene*), large heath butterfly (*Coenonympha tullia*), pyralid moth (*Catoptria permutatella*), cousin German moth (*Paradiarsia sobrina*), a cranefly (*Rhabdomastix hilaris*), a wolf spider (*Arctosa cinerea*).	Six species of local significance	Local
F27	Mesotrophic semi-improved grassland, which gives way to improved fields with abundant gorse scrub. Also contains Crynoch Burn (F26), which has dense pockets of bracken.	Lepidoptera, Araneae, Coleoptera	Pearl-bordered fritillary butterfly (*Boloria euphrosyne*)	One species of national significance	Local

Freshwater Macroinvertebrates, Habitats, and Fish

40.4.102 Freshwater macroinvertebrates, habitats and fish are all closely linked components of the freshwater environment. For example, aquatic habitat complexity supports diverse macroinvertebrate fauna, which are an important food source for fish. As such, these features provide an overall impression of aquatic ecosystem health and so they are all taken together to give an evaluation of each watercourse in terms of its ecological importance.

40.4.103 Overall the watercourses surveyed within the study area ranged in ecological importance from regional to local, with biological status ranging from excellent to fair. A summary of watercourse evaluations is provided in Table 40.15.

Section FL1

40.4.104 Megray Burn was assessed as significantly modified due to areas of re-sectioning, the presence of a major sluice and no fish being caught during the electric fishing surveys. Megray Burn was classified as good biological status based on the macroinvertebrate assemblages and as such has been evaluated as of county importance.

40.4.105 Limpet Burn displayed variation in its degree of modification with the upstream section forming an obviously modified channel with areas of culverting. The downstream section was assessed as being a pristine wetland habitat under the RHS categorisation. No macroinvertebrate sample was taken from the crossing point as there was no discernable channel. Due to the burn being in relatively pristine condition in the vicinity of the crossing point, it has been evaluated as of regional value.

40.4.106 Green Burn was examined near to its source where it flows through scrub as a small shallow channel. One culvert was identified within the stretch and burn is assessed as being obviously modified. Green Burn was classified as having poor biological status as a result of the macroinvertebrate assemblage and as such has been evaluated as of county importance.

Section FL2

40.4.107 Allochie Burn was classified as being of good biological status as a result of the macroinvertebrate assemblage it supports. No river habitat survey was completed on the burn as it was identified to be a field drain. Allochie Burn was evaluated as being of county importance.

40.4.108 Back Burn is a significantly modified channel flowing through semi-improved and unimproved grassland. The burn was classified as of excellent biological status on the basis of the macroinvertebrate assemblages it supports. The burn is considered unlikely to support salmon, but it is likely to support trout. Although the burn was significantly modified, the excellent biological status and presence of trout result in the burn being evaluated as being of regional importance.

40.4.109 The Burn of Muchalls is variable in its degree of modification between its upstream and downstream stretches. Upstream of the crossing point, the burn is obviously modified with evidence of realignment, whilst retaining a degree of semi-naturalness. Downstream of the crossing point, the burn is significantly modified. The macroinvertebrate sample point was at the crossing point and the burn was classified as being of good biological status. Within this area, small salmonids were identified during the surveys. HABSCORE assessments indicated that the burn is unlikely to support salmon though possibly supports trout. This was confirmed on the electric fishing surveys with 0+, 1+ and 2+ trout being identified. Despite the significantly modified nature of the upstream reach, the burn had been evaluated as being of regional importance as a result of the semi-natural downstream section, the good biological status and the presence of trout.

Section FL3

40.4.110 Burn of Blackbutts is an obviously modified field drain, following a field boundary on three sides. The channel was not sampled for macroinvertebrates because water levels were too low. The burn has been evaluated as being of local ecological importance based on the RHS assessment.

40.4.111 Cookney Ditch and Balnagubs Burn are both defined as significantly modified field drains. No macroinvertebrate samples were collected due to low flows at time of sampling. As such, these two watercourses have been assessed as being of local value based on the RHS assessment.

40.4.112 The Burn of Elsick is significantly modified as it is essentially a straightened field drain. The burn was classified as good biological status based on the macroinvertebrate assemblage and has been evaluated as being of local ecological importance.

40.4.113 Whiteside Burn is a significantly modified field drain, with extensive re-sectioning. The burn flows through private land with urban developments and areas of rough pasture. The burn was in good biological status based on the macroinvertebrate assemblage but was evaluated as of local value as the channel is significantly modified.

40.4.114 Crossley Burn is a significantly modified field drain with extensive re-sectioning and poaching of both left and right banks. Macroinvertebrate samples were taken from two points downstream of the crossing point, which offer differing habitat. The burn was identified to be of fair biological status as a result of the macroinvertebrate assemblages present. It is unlikely that the burn supports salmon, though it is possible that it supports trout. Although the burn is significantly modified and is of fair biological status, the possible presence of trout means that the burn has been evaluated as being of county value.

Table 40.15– Summary Watercourse Evaluation

Section	Watercourse	Habitat Area	Size (km^2)	Macroinvertebrate Classification	RHS Habitat Classification	HABSCORE Salmon/Trout presence	Electric Fishing Presence	Evaluation	Comment
FL1	Megray Burn	F3, F4	0.57	Good	Significantly modified	-	No fish	County	None
		F3, F4				-			
	Limpet Burn	F7	1.37	-	Pristine	-	-	Regional	The Burn has been evaluated as of regional importance as a result of the pristine nature of the downstream sections in the vicinity of the crossing point.
		F7		-	Obviously modified	-			
	Green Burn	F10, F8	0.75	Poor	Obviously modified	-	-	County	Although the burn is small and culverted, it retains a degree of semi-naturalness, though is classified as of poor ecological health
FL2	Allochie Burn	F12, F14	0.01	Good	-	-	-	County	
	Back Burn	F13	2.76	Excellent	Significantly modified	Salmon – unlikely Trout – possible	Trout 0+, 1+	Regional	Although it is significantly modified it is showing excellent ecological health.
	Burn of Muchalls	F15	6.74	Good	Upstream – Obviously modified	Salmon – unlikely Trout – possible	Trout 0+, 1+, 2+	Regional	Although historically realigned, it retains a degree of semi-naturalness, with good ecological health.
					Downstream – Significantly modified	-			
FL3	Burn of Blackbutts	F16	-	-	Obviously modified	-	-	Local	None
	Cookney Ditch	F18	-	-	Significantly modified	-	-	Local	None
	Stoneyhill Ditch	F18	-	-	Significantly modified	-	-	Local	Not surveyed, inferred from Cookney Ditch.
	Balnagubs Burn	F18	-	-	Significantly modified	-	-	Local	None
	Burn of Elsick	F18	0.98	Good	Significantly modified	-	-	Local	None
	Whiteside Burn	F20	0.40	Good	Significantly modified	-	-	Local	None
	Crossley Burn	F22	0.20	Fair	Significantly modified	Salmon – unlikely Trout – possible	-	County	Possibly supports trout.

Wintering Birds

40.4.115 The ecological value of each Quadrat for wintering birds was determined by considering the evaluation of its habitat potential (derived from information in Appendix A40.1) combined with the value of the wintering bird assemblage present (refer to Appendix A40.10).

40.4.116 An assessment was then made of the representativeness of the habitats found in each Quadrat in relation to the non-surveyed areas adjacent. The ecological value of the remaining Habitat Areas in each route section was then determined by an initial evaluation of their habitat potential for wintering birds combined with the knowledge of the wintering bird assemblages found in adjacent representative Quadrats.

40.4.117 All Quadrats were subject to five wintering bird surveys and their representativeness of the remaining habitats throughout the route corridor combined with the survey effort is deemed sufficient to provide a comprehensive evaluation of the wintering birds assemblages present.

40.4.118 The following summary presents an evaluation of habitats and wintering bird populations according to Quadrats for each route section in the study area (full details are presented in Table 17 Appendix A40.4).

Section FL1

40.4.119 Three Quadrats (Stonehaven Junction, South of Coneyhatch and Cantlayhills) are located within Section FL1.

40.4.120 Quadrat 1 comprises arable and improved fields with areas of scattered scrub and parkland/scattered trees with areas of broad-leaved woodland. Megray Burn bisects the Quadrat south of H Ram Wood. Quadrat 2 comprises mature coniferous plantation woodland, some riparian woodland associated with Limpet Burn, and arable fields bordered by native species-rich hedgerows with pockets of scattered and dense scrub. Quadrat 3 comprises an acid dry heath/acid grassland mosaic, some improved grassland fields, mixed scattered trees and several small pockets of semi-natural broad-leaved woodland. Habitats within the Quadrats were assessed as being of low, medium and high value respectively. In terms of the value of the wintering bird populations they support, Quadrat 1 and Quadrat 2 are assessed as being of local ecological value and Quadrat 3 is assessed as being of county ecological value.

Section FL2

40.4.121 Quadrat 4 – Northwest of Burnside comprises fields of arable and improved grassland bounded by native species-poor hedgerows, lines of broad-leaved standard trees, earth banks and stone walls. Part of the Burn of Muchalls is also present which supports semi-natural riparian woodland interspersed with areas of semi-improved grassland on the banks. The habitats within Quadrat 4 are assessed to be of high value. In terms of its wintering bird assemblage, Quadrat 4 is assessed to be of county ecological value.

Section FL3

40.4.122 Four Quadrats (Cookney, South of North Rothnick, Stranog Hill and Blaikiewell) are located within Section FL3.

40.4.123 Quadrat 5-Cookney comprises largely arable and improved fields, with a small area of marshy grassland and an area of dense/continuous scrub. Quadrat 6-South of North Rothnick is of a similar composition to Quadrat 5 with occasional watercourses present. Quadrat 7-Stranog Hill again supports a similar habitat composition and includes an area of dry heath/acid grassland mosaic. Quadrat 8-Blaikiewell comprises semi-improved, improved and arable grassland, a small area of marshy grassland and occasional standard broad-leaved trees planted around the Blaikiewell Burn. Habitats are assessed as high value in Quadrat 5, of medium value in Quadrats 6 and 7 and low value in Quadrat 8. With respect to wintering bird assemblages, all Quadrats within Section FL3 are assessed as county ecological value with the exception of Quadrat 6, which is of local ecological value.

Table 40.16 – Summary Evaluation of Habitats and Species

Ecological Receptor	Area	Ecological Habitat Area	Features of Interest to Receptor	Evaluation
FL1				
Terrestrial Habitats	Slicewells Wood	F5	Viable area of semi-natural wet birch broad-leaved woodland listed in the AWI. Wet woodland is listed as a UKBAP and LBAP Priority Habitat. This Area also connects to other wetland habitats, including fen (F12).	Regional
	Megray Wood	F6	Mature conifer plantation (LHAP priority) with an LHAP small burn which supports and connects to viable area of more species-rich wet woodland (UKBAP priority habitat).	Regional
	Limpet Burn	F7	Mosaic of semi-natural communities along the heavily vegetated Limpet Burn. Communities include a dense marsh with scattered willow carr, wet birch woodland (UKBAP priority habitat), dense bracken and continuous gorse scrub. Area included on the AWI.	Regional
Badger	Limpet Burn and Megray Wood (Group B) Urn Burn (Group A)	F6, F7	One main sett (Social Group B) Limpet Burn Wood and Megray also offer alternatives to main sett, provide secure commuting and alternative foraging habitat.	County
Bat	Agricultural fields between the A90 and Stonehaven	F1	Low overall potential for bats; scrub and amenity grassland beside the railway line and the A90 provide some potential for foraging	County
	Agricultural fields west of New Mains of Ury	F2	Broadleaved shelterbelt woodland provide a sheltered foraging and commuting route and potential roosts in trees	County
	Agricultural fields north of Megray Farm	F3	Megray Burn is a commuting route for pipistrelle bats; roosts were identified at New Mains of Ury Farmhouse and Farm, Megray Farm Steading and Forester's Croft. A culvert over Megray Burn provides potential roost opportunities.	Regional
	Wood to the north west of Megray Farm	F4	Plantation woodland on Megray Burn provides low roost potential but some shelter along a commuting route.	County
	Slicewells Wood	F5	The woodland contains a number of mature broadleaved trees with roost potential; excellent foraging habitat along a commuting route (the B979).	County
	Megray Wood	F6	The edges of the wood and rides within it provide linear features along which bats commute and forage; a culvert provides roost potential.	County
	Limpet Burn	F7	The mosaic of semi-natural habitats in this habitat area including march, ponds, the burn, scrub, wet woodland and plantation woodland, provide excellent foraging habitat in a sheltered valley, used by pipistrelles and potentially Daubenton's bats. Many mature trees have roost potential.	County
	Agricultural fields around Coneyhatch Farm	F8	Agricultural fields of low value to bats; linear features including scrub-lined tracks provide commuting potential. Roosting opportunities exist in farm buildings and cottages.	County
	Kempstone Hill	F9	Habitat Area of limited value to bats due to high exposure levels	Less than local
	Fishermyre Wood	F10	Semi-natural broadleaved woodland provides excellent commting and foraging habitat, although high exposure levels in the heath. Fishermyre Farmhouse has potential for roosting bats.	County

Ecological Receptor	Area	Ecological Habitat Area	Features of Interest to Receptor	Evaluation
	Woodland north of Fishermyre	F11	Mixed woodland provides shelter and foraging and commuting habitat for pipistrelle bats adjacent to the B979.	County
Breeding Birds	Limpet Burn (SOV)	F7	Mosaic of semi-natural habitats dominated by dense marsh with scattered willow, birch woodland, dense bracken and continuous gorse scrub, providing high value habitat to breeding birds.	County
	South Fishermyre (SOV)	F10	A large mosaic of gorse scrub-acid grassland with some dry heath vegetation providing medium value habitat to breeding birds.	County
	Fishermyre Wood West	F11	A mix of medium value habitats for breeding birds comprising semi-natural broadleaved birch wood towards the edge with B977, combined with dense continuous gorse scrub. Behind the birch wood is a Scots pine conifer plantation, with acid grassland underneath and beyond. The hill to the north is composed of semi-improved neutral grassland.	County
Otter	Megray Burn	F3, F4 and F7	Otters are present and the burn provides cover scrub, trees and overhanging banks and rabbit holes, well placed between Limpet Burn to the east and the Burn of Glithno to the west, while high cover in Megray Wood provides lying up opportunities. Otters are thought to use the channel infrequently	County
	Limpet Burn	F6, F7	Otters are present and the ponds at Limpet Burn provide a stable supply of fish and other prey items. The upstream section including Megray Wood provides abundant lying up opportunities suitable for breeding, with a potential couch recorded near the ponds. Otters are known to use the burn extensively and may travel between Limpet, Megray and Glithno Burns and along field drains to the north of Megray Wood	Regional
	Coneyhatch Burn	F8, F10	No signs but suitable lying up habitat and likely to be a commuting route between Limpet Burn and Green Burn/Fishermyre	County
	Green Burn	F8	Spraints indicate use by otters; likely to be commuting route between Limpet Burn and Burn of Muchalls	County
	Fishermyre Pond	outside study area	Abundant signs; pond provides reliable fish stocks and temporary lying up opportunities.	County
Red Squirrel	Megray Wood (FLW2)	F6	Red squirrel sighted approximately 50m away in nearby broadleaved woodland although foraging opportunities for red squirrels restricted due to plantation being dominated by Sitka spruce. Mature Sitka will produce mast but this monoculture is unlikely to provide a year round food resource. Red squirrels may utilise the woodland intermittently as a refuge.	County
Water Vole	Coneyhatch Burn and associated ditches	WB4 and F8, F10	High quality habitat that may therefore offer an important habitat resource to the wider Fishermyre water vole metapopulation	County
	Green Burn, the drain at Fishermyre Moss , Fishermyre Moss and Fishermyre Pond	WB5,6,7 and 8 and F8, F12	These are high quality habitats that do support a water vole metapopulation	National
Water Shrew	Megray Burn	F3, F4 and F7	The watercourse provides low to high quality riparian habitat for burrowing and good invertebrate assemblages for foraging.	Local
	Limpet Burn	F6, F7	The watercourse provides moderate to high quality riparian habitat for burrowing and good invertebrate assemblages for foraging.	Local

Ecological Receptor	Area	Ecological Habitat Area	Features of Interest to Receptor	Evaluation
	Green Burn	F8	The watercourse provides high quality riparian habitat for burrowing but poor invertebrate assemblages for foraging.	Less than Local
Amphibians	Fishermyre Ponds (E and W)	outside study area	One large pond offering high value aquatic and terrestrial habitat and one small pond offering medium aquatic and terrestrial habitat that could potentially support populations of common frog and palmate newt. A juvenile palmate newt found in terrestrial habitat around Fishermyre pond (E).	Local
	Crossley Pond	outside study area	Small man-made quarry pond with limited cover used by fishermen but stocked with a reliable source of fish, offering high value aquatic and terrestrial habitat which could potentially support populations of common frog, common toad and palmate newt.	Local
Brown Hare	Hill of Megray	F3	Medium value habitat with arable fields south of Limpet Wood and the Logie Trout Fishery and directly west of Logie Farm, it provides less than optimal foraging, but there is good cover within field boundaries, Limpet Wood and dense scrubby gorse.	Local
	Coneyhatch, Burn of Muchalls	F8	Medium value habitat offering many small crop fields directly east of Broomhill Farm and extending eastward toward the Burn of Muchalls provide many and varied foraging. Excellent cover in set-aside ground, ditches, field boundaries and dense gorse thickets.	Local
Reptiles	Slicewells Wood, Limpet Burn, Megray Wood, Fishermyre woods south	F5, F6, F7, F9 F10	A sighting of a common lizard within Habitat Area F7. These wetland habitats include wet woodland scrub and heath and are directly connected to one another or within close proximity forming an extensive habitat throughout which reptiles can live.	Local
Terrestrial Invertebrates	Megray Wood	F4, and F6	H Ram Plantation and Megray Wood are mature conifer plantations. Megray has a small burn, supporting and connecting to a viable area of more species-rich wet woodland, with potential to support locally significant species.	Local
	Slicewells Wood (AWI)	F5	Wet birch woodland on the AWI, with the potential to support locally significant species	Local
	Limpet Burn	F7	There is a mosaic of semi-natural communities along the heavily vegetated Limpet Burn. Communities include a dense marsh with scattered willow carr, wet birch woodland, dense bracken and continuous gorse scrub.	Local
	Area surrounding Fishermyre	F11	A mix of semi-natural broadleaved birch wood with potential to support species of local significance	Local
Freshwater Ecology	Megray Burn	F3, F4	Variable habitat complexity, ranging from field drain to meandering reaches flowing through woodland	County
	Limpet Burn	F7	The burn has been evaluated as of regional importance as a result of the pristine nature of the downstream sections in the vicinity of the crossing point	Regional
	Green Burn	F8, F10	Although the burn is small and culverted, it retains a degree of semi-naturalness and habitat complexity	County
Wintering Birds	Kempstone Hill	F9	A large mosaic of gorse scrub-acid grassland with some dry heath vegetation providing medium value habitat to wintering birds.	County
	South Fishermyre	F10	A large mosaic of gorse scrub-acid grassland with some dry heath vegetation providing medium value habitat to wintering birds.	County

Ecological Receptor	Area	Ecological Habitat Area	Features of Interest to Receptor	Evaluation
	Fishermyre Wood West	F11	A mix of medium value habitats for wintering birds comprising semi-natural broadleaved birch wood towards the edge with B977, combined with dense continuous gorse scrub. Behind the birch wood is a Scots pine conifer plantation, with acid grassland underneath and beyond. The hill to the north is composed of semi-improved neutral grassland.	County
FL2				
Terrestrial Habitats	Burn of Muchalls	F15	LHAP riparian habitat surrounding the Burn of Muchalls, including small and localised areas of semi-natural UKBAP wet woodland and young mixed plantation woodland.	County
Badger	Cantlayhills (Group C) Clayfolds Group (D)	F16	One main sett (Cantlayhills Social Group D) in willow carr scrub and generally a lack of cover Social Group C are also using this section for foraging	County
Bat	Wet habitats south of Allochie Croft	F12	Heathland with scrub borders, shelterbelts and pockets of woodland provide relatively exposed foraging habitat adjacent to the B979 commuting route.	County
	Agricultural fields surrounding Hill of Muchalls	F13	Roost at Woodview; potential roost in bridge over Back Burn. Mixed plantation woodland, shelterbelts and patches of scrub provide foraging habitat	Regional
	Heath by Allochie	F14	A small area of heathland that has not yet been grubbed up for agriculture provides foraging potential of medium value with medium potential commuting along the track on the southern edge.	Local
	Burn of Muchalls	F15	High value riparian habitat, ponds and mixed woodland. Daubenton's and pipistrelles forage and commute along burn; roosts at Burnside and Burnorrachie Croft, further potential roosts in trees.	Regional
	Agricultural fields fom north of Burn of Mucalls to Cookney	F16	Five building roosts (Cookney Grange, Mains of Cookney, Elrick, Kirkton, Cairnlea) including possible brown long-eared roost at Elrick; and Draubenton's bat roost in a culvert. Shelter belts and hedgerows provide foraging and commuting routes	Regional
Breeding Birds	North Fishermyre (SOV)	F12	Mosaic of habitats dominated by coniferous plantation woodland, mature deciduous and mixed parkland/scattered trees, dense scrub, semi-improved neutral grassland and continuous bracken providing medium value habitat to breeding birds.	County
	Burn of Muchalls (Quadrat 4)	F13,15,16	The Burn of Muchalls bisects the Quadrat from west to east and is dominated by semi-natural wet woodland in the east and young mixed plantation woodland in the west. The burn also contains fishing ponds	County
Otter	Back Burn	F13	Abundant signs, couch and potential lying up opportunities	Regional
	Burn of Muchalls	F15	Abundant signs including juvenile prints; Couch identified near ponds. Burn provides link to coastal resources	National
Red Squirrel	There are no suitable red squirrel habitats in Section FL2	n/a	n/a	n/a
Water Vole	There are no water vole habitats above local value in Section FL2	n/a	n/a	n/a
Water Shrew	Allochie Burn	F12	Has potential for water shrew habitats due to good ecological health based on the invertebrate assemblage, which shows that the water quality is high. The bank vegetation along Allochie Burn is variable.	Local

Ecological Receptor	Area	Ecological Habitat Area	Features of Interest to Receptor	Evaluation
	Back Burn	F13	Has potential for water shrew habitats due to good ecological health based on the invertebrate assemblage, which shows that the water quality is excellent, some sections are heavily poached by cattle and so unsuitable for water shrews although there are patches of good habitat.	Local
	Burn of Muchalls	F15	Has potential for water shrew habitats due to good ecological health based on the invertebrate assemblage, which shows that the water quality is high.The vegetation suitability is high.	Local
Amphibians	Elrick Ponds	F15	Elrick Ponds Large and Small (FL15) lie along side the Burn of Muchalls and are surrounded by young mixed plantation woodland and marshy grassland. The large pond is approximately 60m long and the small pond 20m, the are both approximately 20-30cm in depth capable of supporting palmate newt, frog and toad.	County
Brown Hare	Allochie and Elrick farms	F13	Mixture of large and small arable fields with also cattle-poached fields between Allochie and Elrick farms with some set aside provide less than optimal foraging. Cover from dense gorse scrub and field boundaries.	Local
	Clayfolds and Easterfield	F14	Extensive mixture of large and small arable and cattle fields extend from Floors, southward to Elrick, and eastward to just north of Clayfolds and Easterfield, which provide less than optimal foraging. Cover provided by scrubby field boundaries.	Local
	Burnside of Newhall	F16	Mixture of large arable and cattle fields to the north of West-Town of Newhall extending to Burnside of Newhall provide less than optimal foraging. Cover found along field boundaries.	Local
Reptiles	Howieshill and Hill of Muchalls	F12, FL15	Habitat Area F12 is continuous with habitat in HA F11 and habitat in Section FL1, so is of local importance. F15 provides a range of habitats and features of benefit to reptiles and is continuous with habitat outside the route corridor so the ecological importance is local.	Local
	Areas surrounding Burn of Muchalls	F14, F16	Small and isolated areas of arable fields and a small area of heath	Less than Local
Terrestrial Invertebrates	Fishermyre Wood and surrounds	F12	The majority of this area is dominated by dry heath. The north and north west is lined with dense gorse scrub. Mixed semi-natural woodland is present towards the south west with scattered pockets of willow dominated wet woodland ranging across the south. Fen is present in the environs of the wet wood with the potential to support locally important species	Local
	Areas surrounding Burn of Muchalls	F15	Riparian habitat surrounds the Burn of Muchalls, including small and localised areas of semi natural wet woodland and young mixed plantation woodland with the potential to support locally important species	Local
	Elrick Wood	F16	Elrick Wood is a Sitka spruce plantation. The north is mature, whilst the south is relatively recently planted with the potential to support locally important species	Local
Freshwater Ecology	Allochie Burn	F12, F14	Burn is classified as being of good biological status as a result of the macroinvertebrate assemblage it supports	County
	Back Burn	F13	Although the channel and banks are significantly modified, the burn supports a diverse macroinvertebrate fauna, indicating excellent ecological health	Regional
	Burn of Muchalls	F15	Although historically realigned it retains a degree of semi-naturalness, with good ecological health.	Regional
Wintering Birds	North Fishermyre	F12	Mosaic of habitats dominated by coniferous plantation woodland, mature deciduous and mixed parkland/scattered trees, dense scrub, semi-improved neutral grassland and continuous bracken providing medium value habitat to wintering birds.	County

Ecological Receptor	Area	Ecological Habitat Area	Features of Interest to Receptor	Evaluation
	Burn of Muchalls (Quadrat FL-Wb04)	F13,15,16	The Burn of Muchalls bisects the Quadrat from west to east and is dominated by semi-natural wet woodland in the east and young mixed plantation woodland in the west. The burn also contains fishing ponds. These habitats provide medium value habitat for wintering birds.	County
FL3				
Terrestrial Habitats	Wet habitats north of Cookney	F17	Series of wetland habitats including UK BAP lowland bog and heathland.	County
	Stoneyhill	F19	Species-rich marshland with UK BAP willow carr developing.	County
	Wet habitats around East Crossley	F21	The habitats grade from LHAP soft rush dominated fields to a more ecologically valuable dry heath (UK BAP Lowland Heathland)/acid grassland mosaic. Scrub is frequent.	County
	Dry heath/acid grassland mosaic to the west of Wedderhill	F23	Dry heath with wet heath characteristics (UK BAP Lowland Heathland)/acid grassland mosaic. Patches of wet heath leading onto bog are also present.	County
	Bog/heath to the immediate west of Wedderhill	F24	Wet heavily modified bog with dry heath (UK BAP Lowland Heathland), UK BAP wet birch woods and scattered broadleaves and conifers, plus a small vegetated burn (Rivers and Burns LHAP) is present with a pool of standing water.	County
	Floodplain and immediate surrounds of Crynoch Burn (south)	F27	Mesotrophis semi-improved grassland (LHAP Species rich grassland) giving way to improved fields with abundant gorse scrub. Also contains the Crynoch Burn – part of the River Dee SAC catchment.	Regional
Badger	Stranog Hill (Group F) West Stoneyhill Group (E) Craigentath (Group G)	F22, F23	Most important sett in territory (Stranog Hill Social Group F), with alternative locations available in surrounding gorse scrub, offers secure commuting and foraging for Social Groups E and G (setts outside study area)	Regional
Bats	Cookney	F17	Two roosts (Hillend and Mains of Cookney)	Regional
	North Cookney	F18	Roost at North Cookney Croft; dykes, drainage channels, tree lines and scrub pockets provide mosaic of foraging and commuting habitats; roost potential in culverts.	Regional
	Harecraig	F19	Scrub north of Harecraig provides potential foraging, roosting and commuting opportunities	County
	Agricultural fields around Stripeside	F20	Agricultural fields of low value with occasional scrub; pipistrelles and Daubenton's bats forage over Crossley Pond	County
	Wet habitats around East Crossley	F21	Two roosts (Crossley Farm Steading, Crossley)	Regional
	Agricultural fields from Quoscies – Stranog	F22	One roost at Altries Manse; scrub provides potential commuting feature near roost.	Regional
	Dry heath/acid grassland mosaic to west of Wedderhill	F23	Heath and scrub provide potential foraging habitat although exposed in centre.	Local

Ecological Receptor	Area	Ecological Habitat Area	Features of Interest to Receptor	Evaluation
	Bog/Heath to immediate westof Wedderhill	F24	Bog and heath, birch woods and scattered trees and wet habitats provide potential foraging and commuting habitat	Local
	Plantation woodlands south of Stranog	F25	Scrub provides only shelter	Local
	Agricultural fields south of Polston Farm	F26	One roost (Barn at Greens of Crynoch)	Regional
	Floodplain and immediate surrounds of Crynoch Burn	F27	Excellent foraging habitat and linear feature connecting to Kingcausie in the north	County
Breeding Birds	Cookney	F17	A large mosaic of marsh/marshy grassland with areas of patchy gorse scrub, together with three large stands of willow carr woodland providing medium value habitat to breeding birds.	County
	Harecraig	F19	Mosaic of patchy alder, willow and birch scrub/woodland on an area of marsh/marshy grassland with patches of wet heath vegetation and gorse scrub providing high value habitat to breeding birds.	County
	Crossley (Quadrat 7)	F22	Arable and improved fields with a mosaic of semi-improved and marshy grassland/gorse scrub.	County
	Polston (Quadrat 8)	F27	Semi-improved grassland (much of which is rank or wet and not intensively grazed) with areas of gorse/ willow scrub and heath vegetation. There is coniferous plantation woodland that supports mixed scrub and rough grassland along the edge of the plantation	County
	Wet Habitats around East Crossley	F21	Habitats are of medium value to breeding birds; grading from wet agricultural fields in the north to a dry heath/acid grassland mosaic. Scrub is frequent and is particularly invasive within the dry heath habitat. Representative of Harecraig SOV and is assessed as being of county value.	County
	Dry Heath/Acid Grassland Mosaic to the West of Wedderhill	F23	Habitats are of medium value to breeding birds; comprising dry heath/acid grassland mosaic and occasional bog. Representative of Harecraig SOV and is assessed as being of county value.	County
	Bog/Heath to the Intermediate West of Wedderhill	F24	Habitats are of high value for breeding birds. Wet modified bog is the dominant habitat in the western section – dry heath, wet birch woods and scattered trees in the eastern section. A small vegetated burn is present with a pool of standing water. Representative of Harecraig SOV, and assessed as being of county value	County
Otter	Burn of Blackbutts	F16	Spraints indicate use by otters; burn provides connectivity with coastal resources	County
	Balnagubs Burn	F18	Spraint indicates use by otters; burn forms part of network of drainage ditches connected to Burn of Elsick	County
	Burn of Elsick	F18	Three couches; many potential lying up sites, forms main part of large field drain network used by otters	Regional
	Crossley Burn	F22	No signs; burn provides commuting route between Burn of Elsick and Crossley Pond	County
	Crossley Pond	outside study area	Spraint indicates use by otters; reliable fish stocks.	County
Red Squirrel	East Crossley Wood (FLW5)	F24	No red squirrels were recorded in this woodland which is isolated with low value habitat due to poor foraging opportunities and lack of cover	Less than local

Ecological Receptor	Area	Ecological Habitat Area	Features of Interest to Receptor	Evaluation
	Craigentath Wood (FLW6)	outside study area	No red squirrels recorded but abundant foraging and breeding opportunities provided through dominance by mature coniferous species. Although it is isolated, with little connectivity to surrounding woodland areas, it is potentially suitable for the species due to the mixture of tree species present.	County
Water Vole	There are no water vole habitats above local value in Section FL2	n/a	n/a	n/a
Water shrew	Burn of Elsick	F18	Has potential for water shrew habitats due to good ecological health based on the invertebrate assemblage, which shows that the water quality and vegetation suitability is high.	Local
	Whiteside Burn	F20	Has potential for water shrew habitats due to good ecological health based on the invertebrate assemblage, which shows that the water quality is high and the vegetation is of moderate suitability.	Local
	Crossley Burn	F22	Has potential for water shrew habitats due to fair ecological health based on the invertebrate assemblage, which shows that the water quality is high and the vegetation is of moderate suitability.	Local
Amphibians	Crossley Pond	outside study area	Pond offers high value aquatic and terrestrial habitats that could potentially support populations of common frog, common toad and palmate newt.	Local
Brown Hare	Burnside of Newhall	F18	Mixture of large pasture fields, scrub and marshy fields to the north of Burnside of Newhall, extending westward to South Rothnick and northward to West Quoscies provide close to optimal foraging. Cover found in gorse boundaries, willow scrub and juncus thickets suitability confirmed by four separate sightings of a total of 12 individuals.	County
Reptiles	Cookney and Stoneyhill	F17 F19	Series of wetland habitats including UK BAP lowland bog and heathland, species-rich marshland with UK BAP willow carr developing. These are large areas with high connectivity	Local
	Wedderhill and Stranog	F22, F23 and F24	Large contiguous areas of wet heath, bog, and scrub	Local
	South of Crynoch Burn	F27	This area is contiguous with suitable habitat in Section SL1, as mesotrophic semi-improved grassland is dominant to the south, giving way to improved fields with abundant gorse scrub.	Local
Terrestrial Invertebrates	Areas north Cookney and Areas surrounding East Crossley	F17 F19 F21,F23 and F24	A range of Wetland habitats, including wet modified bog, marshy grassland dominated by soft rush and grasses. Willow and gorse are frequent throughout the area, both as dense patches and scattered scrub.	Local
	Agricultural fields between Cookney and North Rothnick	F18, F20	Predominantly agricultural fields with occasional scattered and continuous gorse which has the potential to support both nationally and locally significant species	Local
	Area north of East Crossley Burn	F24	A very young plantation woodland underlain by dry heath/acid grassland mosaic with the potential to support both nationally and locally significant species	Local
	Area east of Stranog Burn	F25	Mesotrophic semi-improved grassland, which gives way to improved fields with abundant gorse scrub. Also contains Crynoch Burn (FL26), which has dense pockets of bracken.	Local
Freshwater Ecology	Crossley Burn	F22	Most variable discharge of all the burns in the Fastlink section, possibly supporting trout.	County

Ecological Receptor	Area	Ecological Habitat Area	Features of Interest to Receptor	Evaluation
Wintering Birds	Crossley	F21	Habitats are of medium to high value for wintering birds; grading from wet agricultural fields in the north to a dry heath/acid grassland mosaic. Scrub is frequent and is particularly invasive within the dry heath habitat.	County
	East Crossley	F22	Arable and improved fields with a mosaic of semi-improved and marshy grassland/gorse scrub. These habitats provide medium value habitat for wintering birds.	County
	East of Stranog	F23	Dry heath/acid grassland mosaic on a level area of ground. Grassland dominates overall with scattered shrub occasional. Patches of wet heath leading onto bog are also present. These habitats provide high value habitat for wintering birds.	County
	North of Carinfield Burn	F24	Wet modified bog is the dominant habitat, this being of a higher value in the western section. The eastern section of this area is more modified, containing areas of dry heath, wet birch woods and scattered broadleaves and conifers. A small vegetated burn is present with a pool of standing water. These habitats provide medium to high value habitat for wintering birds.	County
	Stranog Burn	F25	An area of young mixed plantation woodland underlain by dry heath/acid grassland mosaic similar to that of F24. These habitats provide medium to high value habitat for wintering birds.	County
	Crynoth/Craigentath	F26	Dominated by improved fields, scrub is rare but marshy grassland is present to the west of Burnhead. These habitats provide medium value habitat for wintering birds.	County
	Wet Habitats around East Crossley	F27	Mesotrophic semi-improved grassland is dominant to the south, giving way to improved fields with abundant gorse scrub. These habitats provide medium value habitat for wintering birds.	County

40.5 Potential Impacts

Introduction

40.5.1 Roads have several well documented potential impacts associated with their construction and operation. This section identifies the potential risks and predicts the associated impacts upon ecological receptors without mitigation. The potential impacts outlined below are: mortality from road construction, mortality from collision with vehicles, modification of animal behaviour, alteration of the physical environment, alteration of the chemical environment, spread of exotics and increased use of areas by humans.

40.5.2 Road construction can lead to the death of sessile and slow-moving organisms, injures organisms adjacent to a road, and alters physical conditions beneath a road. Vehicle collisions affect the demography of many species, both vertebrates and invertebrates. Roads alter animal behaviour by causing changes in home ranges, movement, reproductive success, escape response, and physiological state. Roads can change soil density, temperature, soil water content, light levels, dust, surface waters, patterns of runoff and sedimentation, as well as adding heavy metals (especially lead), salts, organic molecules, ozone, and nutrients to roadside environments.

40.5.3 Not all species and ecosystems are equally affected by roads, but overall the presence of roads is highly correlated with changes in species composition and population sizes, as well as hydrologic and geomorphic processes that shape aquatic and riparian systems.

40.5.4 Potential impacts associated with road developments identified in the DMRB include:

- direct mortality of animals on roads during construction and operation;
- behavioural changes of animals during operation;
- habitat loss through land-take;
- severance or fragmentation of existing habitat areas;
- physical obstructions caused by road constructions and bridges;
- disturbance during construction;
- pollution via road drainage, runoff and spray from road traffic;
- air pollution; and
- visual and light pollution caused by road lighting.

40.5.5 Additionally, for species relying on aquatic resources potentially affected by watercourse crossings, and surface water run-off, the following potential impacts have also been considered:

- point source and diffuse pollution;
- increased sediment loading;
- decreased habitat complexity;
- habitat fragmentation; and
- changes to discharge regime.

40.5.6 These impacts are discussed in general terms followed by consideration of particular aspects relevant to each habitat and species.

Direct Mortality

40.5.7 Work during the construction phase involving vegetation clearance, earthworks and heavy machinery could result in direct mortality of a number of species. Breeding and resting places for particular species such as nests (birds), dreys (red squirrel), setts (badgers), holts (otters), roosts (bats) and redds (salmon) could be occupied during preconstruction clearance. For all protected species and breeding birds, (i.e. those animals for which legal status prohibits disturbance or injury, even while the integrity of the population may not be compromised), direct mortality caused by the construction of the road would constitute a significant impact.

40.5.8 Direct mortality resulting from road traffic accidents (RTAs) during operation could also constitute a significant impact for protected species and breeding birds. Otters, badgers and red squirrel are at particular risk where the road severs their territories or crosses a watercourse.

Habitat Loss

40.5.9 The proposed scheme is predicted to result in direct loss of habitat. This could result in significant adverse impacts both in terms of the actual habitat loss – if the habitat is particularly diverse, rare and/or difficult to replace – and in terms of the species that it supports, for example foraging areas, resting/breeding sites or commuting corridors.

Habitat Fragmentation and Isolation

40.5.10 Without the inclusion of mitigation, the proposed scheme would result in considerable habitat fragmentation both at a local and regional scale. Loss of connectivity between habitats can severely impair the viability of some species' populations. Those species particularly vulnerable in the vicinity of the proposed scheme are red squirrel, where future survival of local populations could be at stake, and bats, where commuting routes can be disrupted, preventing foraging (see below).

Disturbance

40.5.11 Disturbance impacts can range from very serious to negligible, depending on the sensitivity of the ecological receptor, the ability of the receptor to move away from the source of disturbance and the magnitude and duration of the source of disturbance. Continuous disturbance of breeding, resting sites or foraging sites of sensitive animals may result in an adverse impact on the overall viability of the population. Intermittent disturbance of foraging or breeding sites on mobile species where alternative habitat is available would have little or no impact on the local population.

Pollution and Other Indirect Impacts

40.5.12 Accidental spills of chemicals and other potentially toxic substances during construction of the proposed scheme may occur from machinery. Vegetation removal and earthmoving activities may lead to sediment laden runoff reaching watercourses. During operation, there is risk of pollution from surface water runoff contaminated by vehicles or by de-icing salts (which may contribute to saline pollution). The introduction of a new road can change soil density, temperature, soil water content, light levels, dust, surface waters, patterns of runoff, and sedimentation, as well as adding heavy metals (especially lead), salts, organic molecules, ozone and nutrients to roadside environments. Road construction and operation can also result in the physical modification of watercourses through changes to sediment and discharge regimes.

40.5.13 Roads can promote the dispersal of exotic species by altering habitats, stressing native species and providing movement corridors. Native species may also change their home range during operation, resulting in displacement and stress affecting reproductive success. Roads can also promote increased hunting, fishing and the passive disturbance of animals by humans, causing changes in home ranges, movement, reproductive success, escape response, and physiological state. During construction and operation, light pollution may affect the behaviour of nocturnal animals such as bats or alter the behaviour of fish.

40.5.14 Full details of these impacts in relation to habitats and individual species are provided in Appendices A40.1 to A40.10.

40.5.15 In this chapter, the specific impacts on each species are assessed and summarised for each of the Sections FL1 to FL3. Impacts of Negligible or Minor significance are not generally discussed, as it is considered that generic mitigation measures will be sufficient to avoid or reduce these impacts to Negligible residual impacts. Minor and Negligible significance impacts are presented and discussed in the ecological Appendices (A40.1 to A40.10).

40.5.16 Impacts of Negligible or Minor significance are only discussed in this chapter when pertaining to species groups with no separate Appendix reports, i.e. reptiles, amphibians, terrestrial invertebrates, water shrew and hare.

40.5.17 The bat and breeding bird surveys are ongoing throughout 2007 (as explained in sections 40.2.32 and 40.2.39), with findings to be published in an Environmental Report later in 2007. Preliminary analysis of 2007 survey data suggests that there will be no significant changes to the baselines. It is envisaged that the further data will re-confirm the initial assessment.

Impact Significance

40.5.18 Construction and operation impacts are described below and listed in Table 40.20 and Table 40.21. respectively.

Potential Impacts for Habitats and Species

Terrestrial Habitat

40.5.19 Terrestrial habitats would be affected throughout the study area, primarily through habitat loss and fragmentation. Table 40.17 outlines, in general terms, the potential impacts on terrestrial habitats arising from the construction and operation of the proposed scheme.

Table 40.17 – Overview of Potential Impacts on Terrestrial Habitats

Type of Impact	Potential Impacts	Construction Phase	Operation Phase
Direct Habitat Loss	Direct habitat loss would occur along the whole route corridor. Minimum width of habitat loss being approximately 50m, where the proposed scheme is at grade with surrounding land. In areas where a cutting or embankment is required, the width of habitat loss is increased, depending on the extent of the required works.	Yes	Yes
Severance or fragmentation of existing Habitat Areas	The proposed scheme would result in the severance of habitats adjacent to the proposed alignment. Fragmentation of Habitat Areas is likely to occur where the proposed scheme severs existing Habitat Areas, resulting in smaller, more numerous areas of habitat.	Yes	Yes
Physical obstruction caused by road constructions and bridges	The proposed scheme would act as a physical obstruction to the natural movement of species. These impacts are more obvious on animal populations resident in the study area and these are discussed in other specialist reports. However movement of plant species can also be obstructed by physical barriers such as roads.	Yes	Yes
Hydrological disruption	Wetland habitats, including mires, blanket bog and wet heaths, are susceptible to impacts from developments that affect the hydrological regimes of those habitats. Wetland Habitat Areas	Yes	Yes

Type of Impact	Potential Impacts	Construction Phase	Operation Phase
	close to the proposed scheme may be subject to such impacts.		
Pollution via road drainage, runoff and spray	During construction of the proposed road, pollution would likely be predominantly associated with runoff of construction materials onto semi-natural habitats, resulting in adverse impacts to these habitats. During the operation of the road, pollution resulting form road drainage, runoff and spray would likely adversely impact habitats adjacent to the road.	Yes	Yes
Visual and light pollution	Visual and light pollution impacts on existing Habitat Areas are predicted, with the magnitude dependent on the level of road lighting present in specific areas.	Possible	Yes
Air pollution	During the construction phase, particulate deposition of material arising from construction materials may result in limited impacts close to the construction site. During operation of the road, air pollution would likely arise from traffic emissions.	Yes	Yes
Disturbance during construction	Disturbance to habitats would occur during construction. Disturbance to species activities and movements across the works corridor would occur during construction.	Yes	No

Specific Impacts

40.5.20 The total amount of landtake required in order to construct the Fastlink of the proposed scheme is estimated at approximately 1.20km^2 / 120ha. Table 40.18 shows the estimated total pre-construction and post-construction areas of Phase 1 Habitats present within the proposed land-take. The post-construction figures take account of both anticipated habitat loss to construction and habitat created or changed as a result of mitigation.

Table 40.18 – Phase 1 Habitat Areas Pre and Post Construction

Phase 1 Habitat Description	Phase 1 Habitat Categories within proposed scheme land-take	
	Pre-construction (ha)	Post-construction (ha)
Woodland mixed plantation	2.46	13.23
Woodland broadleaved plantation (including standard trees)	0.10	0.78
Woodland broadleaved semi-natural	2.11	0.55
Woodland coniferous plantation	1.28	0.31
Scattered scrub	0.59	1.20
Dense continuous scrub	3.58	7.17
Riparian woodland	0	3.37
Acid grassland semi-improved	0.15	0.13
Acid grassland unimproved	0.40	0.19
Improved grassland	46.29	26.39
Marshy grassland	5.21	2.87
Neutral grassland semi-improved	0.26	0.21
Poor semi-improved grassland	2.96	1.51
Disturbed amenity grassland	0.83	0.37
Arable	49.21	19.64*
Built up areas (buildings)	0.49	0.49
Fen	3.87	1.41
Heath - acid grassland dry mosaic	1.88	1.67
Total	**121.67**	**81.49**

**Figure assumes all potential return to agriculture is achieved.*

25.5.1 Potential impacts on terrestrial habitats are summarised in Table 40.19 and provided in detail in Appendix A40.1.

Table 40.19 – Potential Impacts on Terrestrial Habitats

Habitat Area	Feature/Asset Evaluation	Potential Impact
F1	Agricultural fields between the A90 and Stonehaven Local	Direct habitat loss of farmland by access road. Severance from farmland on other side of proposed scheme. Potential pollution and disturbance impacts.
F2	Agricultural fields west of New Mains of Ury Local	No direct habitat loss. No observable secondary impacts are likely to occur.
F3	Agricultural fields to the north of Megray Farm Local	Direct loss of farmland habitat but not affecting arable weed location. Severance from farmland on other side of proposed scheme. Potential pollution and disturbance impacts.
F4	H Ram Wood Local	Loss of conifer woodland of around 10%. Potential pollution and disturbance Impacts.
F5	Slicewells Wood Regional	No direct habitat loss. No observable secondary impacts would be likely to occur.
F6	Megray Wood Regional	Direct loss of edge habitat of plantation woodland Potential pollution and disturbance impacts.
F7	Limpet Burn Regional	Direct loss of UK BAP and other habitats where proposed scheme would cross. Severance and fragmentation of habitats on either side of proposed scheme. Potential pollution and disturbance to remaining habitats.
F8	Agricultural fields surrounding Coneyhatch and Wyndford Farm Less than local	Direct loss of low value farmland habitat. Severance from farmland on other side of proposed scheme. Potential pollution and disturbance impacts.
F9	Kempstone Hill Local	No direct habitat loss as all habitats of ecological value are greater than 1km from the proposed scheme. No observable secondary impacts would be likely to occur.
F10	Fishermyre Wood south Regional	Direct loss of UK BAP and other habitats where proposed scheme would cross. Severance and fragmentation of habitats on either side of proposed scheme. Potential hydrological impacts on wetland habitats. Potential pollution and disturbance to remaining habitats.
F11	Fishermyre Wood west. Regional	No direct loss. No observable secondary impacts would be likely to occur.
F12	Fishermyre Moss, Fishermyre Wood West. Wet habitats to the south of Allochie Croft Regional	Direct loss of UK BAP habitats of wet woodland and fen. Severance and fragmentation on either side of proposed scheme. Potential hydrological impacts on wetland habitats. Potential pollution and disturbance impacts.
F13	Agricultural fields surrounding Hill of Muchals Local	Habitat loss of farmland. Loss/fragmentation of dry stone walls and species-rich native hedge. Severance from farmland on other side of proposed scheme. Potential pollution and disturbance impacts.
F14	Heath by Allochie Local	No direct habitat loss. No observable secondary impacts are likely to occur.
F15	Burn of Muchalls Regional	Direct loss of stream habitat. Severance and fragmentation of farmland on either side of proposed scheme. Potential pollution and disturbance impacts.

Habitat Area	Feature/Asset Evaluation	Potential Impact
F16	Agricultural fields from north of the Burn of Muchalls to Cookney Local	Direct loss of low value farmland. Severance from farmland on other side of proposed scheme. Fragmentation of six dry stone walls. Potential pollution and disturbance impacts.
F17	Wet habitats north of Cookney County	Direct habitat loss at the extreme southeast edge of habitat. Potential secondary impacts including pollution and disturbance.
F18	Agricultural fields from Cookney to East Rothnick Wood Local	Loss of low value farmland. Severance from farmland on other side of proposed scheme. Fragmentation of nine dry stone walls. Loss of corner of dense gorse scrub. Potential pollution and disturbance impacts.
F19	Stoneyhill County	Loss of marshy grassland and developing UK BAP habitat. Potential hydrological impacts on wetland habitats. Potential pollution and disturbance impacts.
F20	Agricultural fields around Berrytop Less than local	Loss of farmland habitat Potential pollution and disturbance impacts.
F21	Wet habitats around East Crossley County	Loss of wetland habitat. Fragmentation of wetland habitat on either side of proposed scheme. Potential hydrological impacts on wetland habitats. Potential pollution and disturbance impacts.
F22	Agricultural fields from Quoscies to Stranog Less than local	Loss of farmland habitat. Loss of species-poor marshy grassland. Severance of farmland and marshy grassland from other side of proposed scheme. Potential pollution and disturbance impacts. Drying out of marshy grassland plus impacts to adjacent wetland habitat (F21) near East Crossley
F23	Dry heath/acid grassland mosaic to the west of Wedderhill County	Direct loss of acid grassland/wet heath habitat. Severance and fragmentation of habitat either side of the proposed scheme. Drying out of wetland areas with impacts on adjacent wetlands (F24)
F24	Bog/heath to the immediate west of Wedderhill County	No direct loss of habitat. Severance of hydrological connectivity by the proposed scheme could result in drying out of wetland habitat
F25	Plantation woodland south of Stranog Local	Direct loss of plantation woodland. Severance and fragmentation of young plantation. Drying out of acid grassland/heath below plantation North-facing slope suggests no impact upon hydrological connectivity to other habitats
F26	Agricultural fields to the south of Polston Farm Local	Direct loss of low value farmland. Severance from farmland on other side of proposed scheme. Fragmentation of three dry stone walls. No observable secondary impacts are likely to occur.
F27	Floodplain and immediate surrounds of Crynoch Burn (south) County	No loss of habitat No observable secondary impacts are likely to occur.

Section FL1

40.5.21 Disturbance during construction may result in fragmentation and potential pollution of Limpet Burn and Fishermyre Wood. This impact is assessed as being of a high negative magnitude and thus of Major significance.

40.5.22 Habitat loss and fragmentation of Limpet Burn and Fishermyre Wood is predicted to be a medium negative impact of Moderate significance. Impacts from disturbance, hydrological impacts and pollution are potentially of high magnitude and are assessed as being of Major significance.

Section FL2

40.5.23 Temporary habitat severance and disturbance during construction would result in fragmentation and potential pollution of Burn of Muchalls and surrounds. This is assessed as a medium impact of Moderate significance.

40.5.24 Permanent habitat loss of Burn of Muchalls and surrounds is assessed as being of medium impact magnitude and of Moderate significance. Operational impacts caused by disturbance, fragmentation and potential pollution due to particulate or chemical runoff are potentially a high negative magnitude and thus of Major significance.

Section FL 3

40.5.25 Disturbance during the construction phase may result in fragmentation, hydrological impacts and pollution of the wetland habitats in this section. These impacts are potentially of high negative magnitude and of Moderate significance.

40.5.26 During operation of the scheme, habitat loss, fragmentation, hydrological impacts and potential pollution due to particulate or chemical runoff are assessed as being of a high negative magnitude and of Moderate significance.

Badgers

40.5.27 It should be noted that the potential impacts outlined below frequently interact (i.e. habitat loss during construction can potentially result in disturbance and habitat fragmentation). The resulting combination of impacts may, through synergistic effects, significantly increase the adverse impact of the proposed scheme (Luell et al., 2003).

40.5.28 One of the main potential impacts on badgers, associated with the proposed scheme, is direct mortality that would be caused by road accidents once the scheme is operational. This is the greatest cause of recorded badger mortality in the UK and without mitigation measures being put in place comparatively more badgers may be killed on the new road than at present. Furthermore, the operational AWPR would form a barrier to badger movements, severing badger group territories and limiting immigration and emigration. Habitat loss would also have repercussions on the local badger population where badger setts are lost as part the scheme. Construction of the scheme would also disrupt the routines of badgers and may result in some setts being abandoned.

Direct Mortality

40.5.29 Badgers are naturally inquisitive animals and may investigate construction areas during the night. Here there is an increased probability of mortality through badgers becoming trapped in any pits, piping, fuel containers, wire mesh or similar hazard. Any night works may also lead to increased risk of badgers being run-over by works vehicles. Earthworks can lead to the destruction of badger setts and the death of any badgers inside, particularly where sett locations are unknown. This would constitute an offence under current legislation.

40.5.30 The principal cause of badger death during the operational stage of the road would likely be attributable to badgers being struck by traffic as they attempt to cross the new road. Badgers are particularly susceptible where the roads sever existing paths or foraging areas. This is the main cause of badger deaths in the UK. It has been estimated that over 50,000 badgers are killed on roads every year in the UK (Harris et al., 1995).

Habitat Loss

40.5.31 The footprint of the proposed alignment would result in the loss of agricultural and semi-natural habitats (refer to Table 40.18), which potentially represent important setting, foraging and commuting habitat for badgers. Where loss of habitat is likely to be greater than 25% (within an individual social group's territory) the impact could potentially affect the viability of the affected

social group (National Roads Authority of Ireland (NRA) 2005). The siting of activities such as work compounds, borrow pits, soil heaps and material stores may also result in temporary loss of habitat. In addition, construction of the proposed scheme may result in the loss of badger setts, thus displacing social groups from their home range and leading to increased territorial conflict with neighbouring social groups. Without the appropriate licence, the loss or damage of any badger sett would constitute an offence under current legislation.

40.5.32 Edge effects of the road would extend the area of habitat loss beyond the footprint of the scheme with areas of habitat adjacent to the proposed road being avoided, or certain setts being abandoned by badgers due to the disturbance effects of the road. The impacts of habitat loss from the operational phase of the road would be likely to vary between social groups, depending on the extent to which the territory is affected.

Habitat Fragmentation and Isolation

40.5.33 The construction of the proposed scheme is likely to result in minimal severance as badgers would generally be able to freely move across the carriageway before it is operational. Temporary localised fragmentation of individual badger groups' territories may result through disturbance or the construction of temporary barriers such as the fencing of construction corridors. This will be addressed by the Contractor by installing permanent or temporary badger crossings points, early in the construction stage, in consultation with the ECoW.

40.5.34 The operational stage of the proposed scheme is predicted to result in the fragmentation of badger territories through the physical barrier effects of the road. This fragmentation of territories may result in badgers being isolated from potential key areas, e.g. key foraging locations. The reduction in available resources may in turn lead to an increase in territorial conflict between neighbouring social groups, as groups compete for habitat resources, trying to make up for the areas of habitat lost to the proposed scheme by encroaching into neighbouring territories. Badgers are capable of inflicting fatal injuries on each other during territorial disputes (Neal and Cheeseman, 1996) and this may indirectly add to the impacts related to direct mortality.

40.5.35 The barrier effects of the proposed scheme may also restrict immigration and emigration of individuals between social groups, thus decreasing genetic dispersal and potentially leading to increased inbreeding (Madsen et al., 1996). This impact is likely to have a far reaching effect on badgers outside of the study area as well as within, by creating genetically isolated sub-populations on either side of the road.

40.5.36 Fragmentation effects of the proposed scheme may render some areas of habitat unviable in terms of their ability to function as a complete resource for badgers, e.g. the fragmentation of a woodland may make it unsuitable as sett habitat or affect its ability to function as an economic foraging resource through a decrease in overall productivity or species diversity.

Disturbance

40.5.37 During construction, machinery and works may cause disturbance to badgers. Night-time working, involving lighting, noise and movement of people, would be likely to deter badgers from using land around a works area in the short-term. Stores of materials or plant next to an already installed badger-pass may dissuade badgers from using the pass, especially if the plant is used regularly. Similarly, disturbance during the daytime near breeding setts can cause serious disturbance to badgers and mortality of cubs (NRA, 2005). Under current legislation, any works involving heavy machinery within 30m of a badger sett would result in an offence. Any sett exclusions would result in temporary disturbance while badgers are forced to move to a new sett.

40.5.38 During operation, noise and light pollution would be likely to create an envelope of disturbance around the scheme which may perturb badgers from foraging or maintaining setts in close proximity to the alignment, resulting in similar impacts described above. Disturbance could therefore further reduce the overall habitat available to badger social groups that border the road

alignment. The impact of disturbance is likely to be reduced over time as badgers become accustomed to the road.

Pollution and Other Indirect Impacts

40.5.39 During construction, substances such as petrochemicals, lubricants and solvents used for plant and general works may represent an increased risk of badger mortality by means of poisoning, through the potential contamination of waterbodies used by badgers for drinking. Similarly, there is the potential for the contamination of terrestrial habitats leading to a bio-accumulation of contaminants in food resources such as earthworms and rhizomes. High levels of pollutants may therefore accumulate in badgers, resulting in mortality.

Specific Impacts

40.5.40 A summary text for the main impacts associated with the construction and operational phases of the scheme is provided below. Impacts such as loss of foraging habitat or runoff from the scheme, are not covered, as these are considered unlikely to significantly affect badgers, although they may still pose a threat significant impact to for this species, they are not likely to threaten the survival of badger populations in the Fastlink section of the scheme.

Section FL1

40.5.41 The proposed scheme would require the loss of main sett B1, resulting in potential impacts on the social group including displacement from their home range and main sett, increased territorial conflict with neighbouring social groups (Groups A and C) and possible injury or fatality to badgers in the sett. The proposed scheme would also result in the loss of outlier sett B2, resulting in direct mortality or disturbance to badgers using the sett. In addition, the scheme would sever Group B's territory in half and cross several badger pathways, resulting in an increase in badger mortality through territorial conflicts (with Groups A and C) and RTAs.

Section FL2

40.5.42 The proposed scheme would sever the territories of Social Groups D and E and cross several badger pathways leading to fragmentation, disturbance and an increased risk of badger mortality through territorial conflicts and RTAs. These impacts are considered to be of high negative magnitude and Moderate significance.

Section FL3

40.5.43 The operational scheme would sever the territories of Social Groups F and G and cross several badger pathways leading to fragmentation, disturbance and an increased risk of badger mortality through territorial conflicts and RTAs. Habitat fragmentation is predicted to constitute a medium negative impact of Moderate significance, whereas the increased risk of direct mortality is assessed as being an impact of high negative magnitude and Moderate significance.

<u>Bats</u>

40.5.44 The following is a summary of impacts on bats that would likely result from the construction and operation of the proposed scheme. The severity of impacts generally increases with the proximity of roosts to the road.

Direct Mortality

40.5.45 Bats are relatively long-lived. They take several years to reach reproductive maturity and then produce only one offspring a year. They therefore invest a lot of energy into producing relatively few young compared with other similar-sized terrestrial mammals. This makes bat populations particularly susceptible to impacts that compromise their numbers or ability to reproduce (Kunz, 1982).

40.5.46 During construction, there would be a high risk of mortality if bats are roosting in any structure or tree to be demolished or felled. As discussed above, this may have significant impacts on bat populations and in addition confers a risk of prosecution if bats are killed or roosts destroyed, as bats and their resting places are protected by law.

40.5.47 During operation, there would be a risk of RTAs caused by collision with oncoming vehicles. The risk is generally low, as bats are unlikely to be attracted to major roads (DMRB, 2001). However, the risk is increased where the road severs flight lines and where young bats are emerging from maternity colonies, as they are particularly weak fliers. It has been estimated that between 1% and 5% of bats die as a result of traffic accidents (Limpens et al., 2005). The problem is exacerbated by the fact that most of the bat species present in Aberdeenshire fly relatively low above the ground when commuting (Bach et al., 2004).

Habitat Loss

40.5.48 Bats are particularly sensitive to habitat loss and even small patches of habitat may have wide-ranging implications for the bats that use them (DMRB, 2001). High roost fidelity and roost selectivity in certain species (e.g. brown long-eared bats; Entwistle et al., 1997) mean that loss of roost sites may be detrimental to the populations using them. In particular, this may be manifested by the selection of sub-optimal roost sites, which may influence survival rates, especially at sensitive times of year including during hibernation or breeding. Optimal habitats including broad-leaved woodland, habitat corridors and lacustrine/riverine habitats are relatively rare and their distribution scattered (Walsh et al., 1996a,b) and bat populations are likely to be susceptible to changes in resource availability. Although the habitat lost may recover in the medium to long term following the construction period, the quality of the habitat may be reduced, especially if the connectivity between remaining patches is also compromised.

40.5.49 Bats use linear features such as rivers, hedgerows and treelines as commuting routes between roosts and foraging grounds (Limpens and Kapetyn, 1991). The integrity of these habitat features is often critical to the continued viability of bat populations, as bats need to be able to move freely between them (Mitchell-Jones and McLeish, 1999). Therefore, small scale modifications to such features (for example as a result of development) must be taken into consideration when predicting the impacts of a development (Warren et al., 2000) as well as for impacts from direct mortality and fragmentation.

Habitat Fragmentation

40.5.50 Many of the potential impacts of habitat fragmentation and isolation are common to the construction and operation phases, as well as the impacts of habitat loss and direct mortality. Potential impacts include the loss of hedges, fences and tree lines used for navigation by bats. This may be a particularly significant impact for low flying bats, including pipistrelle, *Myotis* species and brown long-eared bats (Limpens and Kapetyn, 1991), causing the isolation of resources and increasing the effort needed to commute between them. This may be exacerbated by the patchiness of roosts and foraging areas used by bats. Severance of commuting corridors and removal of sheltered flyways between patches may affect access to resources and long term survival of populations of bats, particularly where this occurs within 100m of a maternity roost, as pregnant females may need to feed closer to the roost (Racey and Speakman, 1987). The effects of direct habitat fragmentation and isolation are coupled with the risk of RTA due to vehicle collision.

40.5.51 Where the road or junctions would pass directly through areas used by bats, habitat used for roosting, foraging or commuting may be fragmented and isolated. In addition, the severance of flight routes used for commuting between areas of habitat may be caused by the proposed scheme. This may result in the indirect isolation of Habitat Areas where flight lines are not directly severed, but where the road passes between Habitat Areas.

40.5.52 Long term impacts of the proposed scheme are predicted to include the presence of lanes of moving traffic, which would act as a barrier to movement between habitats within the landscape. This is exacerbated by the constraints of echolocation calls in some bat species, including brown long-eared bats (Entwistle et al., 1996). Bats may be deterred from crossing the road if their echolocation calls are unable to penetrate to the other side. While this would have beneficial impacts in terms of reducing the operational impacts of road mortality, it would also reduce resource accessibility, including roost or foraging habitats and forcing bats to use sub-optimal resources. Similarly, the new road may render roosts unviable if it passes between the roost and optimal foraging habitat (personal communication, Mr Rob Raynor, SNH).

Disturbance

40.5.53 The effects of disturbance would likely be most significant during construction, in particular during felling and demolition works. Bats would modify their behaviour to accommodate disturbance over time. Increased human presence and the use of heavy machinery would be likely to cause extra dust, noise and vibration. This may result in disturbance to roosting bats and may even cause bats to abandon a roost, especially if works take place at night and if blasting is used in the construction of cuttings.

40.5.54 Night-time working involving floodlighting may cause disruption of foraging and commuting behaviour (Rydell and Racey, 1993). In particular, the use of lighting close to a roost may influence emergence behaviour and activity. Bright light may cause bats to move away from an area or to desert a roost.

40.5.55 While fast flying bat species such as Leisler's bats and pipistrelles may be attracted to the insects that feed over road lighting, slower flying species including brown long-eared, Natterer's and Daubenton's bats would likely avoid areas where road lighting has been installed (Rydell and Racey, 1993).

40.5.56 Maintenance operations can potentially affect bat roosts in bridges or trees and can cause disturbance to bats in roosts (DMRB, 2001). Bats' colonial habits and dependence on buildings and similar structures for roosting also make them vulnerable to repair work, re-roofing and the use of toxic timber treatment chemicals (Schofield and Mitchell-Jones, 2003).

Pollution and Other Indirect Effects

40.5.57 During construction, fluctuation in water regimes of burns, lochs and wetland areas may occur as a result of channel siltation through embankment construction, cutting excavation, culvert installation and provision of temporary access roads and vehicle washing. These would be likely to bring about modifications to the channel bed morphology and water turbidity (refer to Chapter 39: Water Environment and to the Freshwater reports in Appendices A40.9). In addition, pollution of watercourses during construction or operation may also change the faunal assemblage. Such fluctuations would be likely to result in modification of the insect prey availability with subsequent consequences for foraging bats.

Specific Impacts

Section FL1

40.5.58 During construction, there is a risk of direct mortality where the road would pass through Megray Wood and through woodland habitat adjacent to Megray Burn and Fishermyre. These impacts have been assessed as high negative magnitude and Moderate significance. Fragmentation would be an issue at Megray Burn and the farm access track where commuting routes are to be severed and at Limpet Burn where the eastern edge of Megray Wood would be fragmented. In addition, there would be a potential for disturbance to bats roosting at New Mains of Ury during junction construction. Disturbance to foraging and commuting bats in Megray Wood and Limpet Burn is likely if night works are used and during bridge construction at Limpet Burn. In terms of

fragmentation and disturbance, these impacts have been assessed as being of medium negative magnitude and Moderate significance.

40.5.59 During operation of the proposed scheme, there would be a risk of direct mortality as a result of the scheme severing known commuting routes along Megray Burn, a farm access track, Limpet Burn and two minor roads that have been shown to be used by commuting bats. These impacts are assessed as being of medium negative magnitude and Moderate significance.

40.5.60 Habitat loss of low value conifer plantation adjacent to Megray Burn and Fishermyre is unlikely to constitute a significant impact. However, the loss of high value foraging and roosting habitat in Megray Wood and adjacent to Limpet Burn would be of a greater severity and are assessed as being medium negative magnitude/Moderate significance. The effects of severance of a commuting route along Limpet and Megray Burns, the farm access track and the minor roads would result in areas becoming less accessible. Pollution incidents at Limpet Burn could result in an significant impact to foraging bats if the suitability of Limpet Ponds as foraging habitat is reduced. These impacts have been assessed as medium negative magnitude and Moderate significance. Some disturbance may occur as a result of junction lighting at Megray Burn, but is anticipated to be minor. Impacts arising from habitat loss at Megray Burn and Fishermyre, together with severance and disturbance are assessed as being low negative magnitude and Minor significance.

Section FL2

40.5.61 During construction, direct mortality has been identified as a potential impact along the Burn of Muchalls where a number of trees with roost potential have been identified. The potential impacts associated with the felling of these trees have been assessed as being high negative magnitude and Major significance. Disturbance would occur at Woodview and Elrick Farms where roosts have been identified within 200m of the proposed scheme, particularly if site compounds are sited nearby. These impacts have been assessed as being of medium negative magnitude and Moderate significance.

40.5.62 During operation, direct mortality would occur along a farm access track south of Burnside, the Burn of Muchalls and the Burn of Blackbutts as a result of the severance of commuting routes. These potential impacts have been assessed as being high negative magnitude and Major significance. The loss of habitat at the Burn of Muchalls would have an impact on the suitability of the burn and riparian zone for foraging and commuting bats if provision is not made for bats to fly along the burn.

40.5.63 The proposed scheme would cause the eastern edge of the heathland area north of Fishermyre to be fragmented with potential implications for foraging and commuting bats. Severance of the Burn of Muchalls would result in the loss of habitat either side of the road if bats cannot cross. These impacts have been assessed as medium negative magnitude and Moderate significance on these regional value habitat areas. Potential impacts related to disturbance from traffic noise is anticipated to be minor. The potential for pollution of the Burn of Muchalls from road runoff would reduce the suitability of the burn downstream for foraging bats. These impacts are assessed as being of medium negative magnitude and Moderate significance.

Section FL3

40.5.64 The risk of direct mortality from the loss of habitat is anticipated to be minor as the habitat is of low value to roosting bats. The potential for disturbance where the proposed road would be within 50m of the common pipistrelle roost at North Cookney Croft is anticipated to be low and impacts are assessed as being of low negative magnitude and Minor significance.

40.5.65 The impacts of direct mortality would be considered significant where the road passes close to a pipistrelle roost at North Cookney Croft as roosting bats may fly into the path of oncoming traffic if a safe crossing was not provided. There is also the potential for severance and the risk of direct mortality at that location and along the track adjacent to North Rothnick Farm. These impacts are

assessed as being high negative magnitude and Major significance. Bats roosting in the houses at Cookney would be likely to disperse to the east and north along the road. The loss of valuable foraging and roosting habitat is not considered likely to be a significant impact in this section as most of the habitat is open, often exposed and of relatively low inherent value. The loss of habitat along linear features, of potential value as commuting routes, is considered to be more important. With the exception of the loss of valuable foraging and roosting habitat, which is assessed as being of medium negative magnitude and Moderate significance, impacts arising from dispersal and disturbance are assessed as being of low negative magnitude and Minor significance.

Breeding Birds

Direct Mortality

40.5.66 The risk of direct mortality would be likely to represent a key impact upon bird's eggs and un-fledged young during habitat clearance during construction, with species located in denser habitats such as dense scrub, grassland or woodland being the most vulnerable. Direct mortality would be unlikely to present such an issue for adult birds and/or sufficiently fledged young, since they would be able to escape by moving into unaffected adjacent habitats. Direct mortality of bird eggs and young (from habitat loss and disturbance) would be most likely to occur during the breeding season, typically between March and July, and would constitute a prosecutable offence under the WCA (in particular for those species listed within Schedule 1 of the act).

40.5.67 Many bird species would attempt to cross active roads to move between habitat fragments (Salter, 1994). RTAs typically occur where woodland or scrub habitats are located immediately adjacent to busy roads and it likely that low flying bird species (e.g. members of the thrush family, owls and game birds) would be the greatest affected.

40.5.68 High mortality rates associated with operational roads reduce the exchange of bird populations between habitats and thus increase isolation effects, demonstrating the link between mortality and barrier effects caused by fragmentation (Van Apeldoorn, 1995).

40.5.69 An increase in direct mortality resulting from habitat fragmentation, associated with an increase in number of roads and road traffic within the UK, has been highlighted as a major component in the decline of some bird species such as the barn owl (a WCA Schedule 1 species). It has been observed that twice as many barn owls are now killed by road traffic (an estimated 5,000 individuals per annum) on UK roads as compared with the 1950's (English Nature, 1996).

Habitat Loss

40.5.70 The direct impact of the proposed scheme would be the physical loss of breeding and foraging habitats along the route corridor. The impacts associated with direct habitat loss would be further increased by the interaction of disturbance and fragmentation/isolation impacts. Combined, these impacts can lead to a change in the distribution of species within a route corridor or wider study area (Iuell et al., 2003).

40.5.71 Pre-construction habitat clearance would result in the destruction of potential breeding habitat for bird species. Cumulative impacts would also be likely to arise as a consequence of the destruction of birds' eggs. These could include direct mortality of un-fledged young and the displacement of adults and fledglings by means of disturbance into adjacent un-affected habitat.

40.5.72 Habitat clearance would additionally result in the direct loss of foraging habitat through the loss of plant food groups such as buds or berries and the indirect loss of invertebrate communities. These form a major dietary constituent for the majority of small to medium sized bird species (such as blue tit or song thrush).

40.5.73 Species that would be most adversely affected by this habitat loss are barn owl, bullfinch, grasshopper warbler, grey partridge, kingfisher, lapwing, linnet, reed bunting, skylark, snipe, song thrush, starling and yellowhammer, due to their reliance on wetland and agricultural habitats.

Habitat Fragmentation and Isolation

40.5.74 Bird species diversity and local species extinction has been found to be more pronounced in smaller woods than in larger areas of woodland (Hinsley et al., 1992).

40.5.75 English Nature (1994) reports that the habitats most likely to be affected by fragmentation are woodland, heathland and species rich grassland. Bird species which move between habitats in order to maintain genetic diversity and avoid inter-breeding are the most impacted. The ability to utilise fragmented habitats varies according to species, with greater impacts on those species less able to cross gaps. Some species, such as cuckoo, will not live within several hundred metres of a road. While the barrier effect imposed by the proposed scheme to birds is difficult to assess due to it being variable between species, as a general rule, the busier and wider the road the more effective a barrier it is to dispersion (English Nature, 2001).

40.5.76 Fragmentation and isolation would have an adverse impact on local bird populations through a reduction in dispersal and subsequent isolation of species, which could potentially result in a reduction in population sizes. The extent of these impacts would likely be dependent on the size of the isolated area of habitat and the species affected, as the ability to avoid genetic isolation and localised extinctions by moving between fragmented habitats varies between bird species.

40.5.77 The operational scheme would likely have significant fragmentation and isolation impacts on bird populations, through a restriction in dispersal and movement of species between habitats. There may be disturbance associated with minimal operational maintenance and noise and vibration disturbance caused by road traffic. The continued fragmentation and isolation of bird species within severed habitats could have a detrimental effect on species population dynamics and ultimately on population viability.

Disturbance

40.5.78 Disturbance resulting from noise and vibration associated with construction of the proposed scheme is predicted to occur in two stages. The first stage would comprise disturbance resulting from pre-construction habitat clearance. The second stage would comprise both direct disturbance (e.g. from earth moving machinery) and indirect disturbance. Both direct and indirect disturbance would be likely to contribute to an increase in the effects of Fragmentation and isolation. If severe or prolonged, disturbance may lead to some species of bird failing to nest during the breeding season.

40.5.79 A detailed study on the effects of road traffic noise on breeding bird populations in the Netherlands by Reijnen et al. (1995a) observed that roads used for high speed travel reduced the density of breeding birds within adjacent woodland and grassland habitats. Further research undertaken by Reijnen et al. (1995b) has shown that road traffic noise accounted for lower densities of 43 songbird species in habitats adjacent to operational roads and that the distance from a motorway at which breeding bird densities were affected was influenced by the intensity and speed of traffic (Reijnen et al., 1995a).

40.5.80 Road lighting can have adverse impacts on bird species and can affect both breeding and foraging behaviour in a number of species of bird. These impacts were first observed by Rawson (1932), who demonstrated the correlation between critical light levels at dawn and singing in thrushes, and suggested that artificial lighting could modify the timing of natural behavioural patterns. Impacts from light pollution have also been observed in nocturnal birds such as barn owl (Hill, 1992).

Pollution and Other Indirect Impacts

40.5.81 Ballard and Hacker (1996) have shown that de-icing salt used in the winter to keep roads ice-free can potentially result in the death of seed eating birds such as finches, which consume seeds contaminated by salt. The application of de-icing salt to the proposed scheme during the winter and the indirect pollution of adjacent habitats via vehicle spray could potentially result in the death

of seed eating bird species foraging in habitats located adjacent to the proposed scheme – wide verges with varied nut or berry bearing planting being most likely to be most impacted.

Specific Impacts

Section FL1

40.5.82 Potential construction impacts would include fragmentation/isolation, disturbance and pollution due to accidental spills at Limpet Burn (F7), South Fishermyre (F10) and North Fishermyre (F12). These areas are all assessed as being of county importance for breeding birds. Potential risks are anticipated to be greater at North and South Fishermyre and these impacts have been assessed as medium magnitude and Moderate significance. All other impacts within FL1 are predicted to be between negligible to low negative magnitude and between Negligible and Minor significance.

40.5.83 During the operation of the road, there is the potential risk of direct mortality, fragmentation/isolation, disturbance, habitat loss and pollution due to runoff. Limpet Burn, South Fishermyre and North Fishermyre are assessed as having a county ecological value for breeding birds. Operational impacts within these areas have been assessed as medium negative magnitude and Moderate significance. The exception is the potential impacts that have been identified at Limpet Burn, which have been assessed at low negative magnitude (medium magnitude for pollution) and Minor significance. All other impacts within FL1 are predicted to be between negligible to low negative magnitude and between Negligible and Minor significance.

Section FL2

40.5.84 Potential construction impacts would include fragmentation/isolation, disturbance and pollution due to accidental spills at the Burn of Muchalls (F15) and the area surrounding Cookney (F16). These areas are all assessed as being of county importance for breeding birds. Potential impacts from construction activities have been assessed as low negative magnitude and Minor significance. However, the impacts that would result from risk of pollution of watercourses within these areas has been assessed as being of medium negative magnitude and Moderate significance. All other impacts within FL2 are predicted to be between negligible to low negative magnitude and between Negligible and Minor significance.

40.5.85 During the operation of the road, impacts from direct mortality, fragmentation/isolation, disturbance, habitat loss and pollution due to runoff have been identified. The Burn of Muchalls and the area surrounding Cookney are assessed as county ecological value for breeding birds. The potential for operational pollution in both of these areas, as well as direct mortality, fragmentation/isolation, disturbance and habitat loss at the area surrounding Cookney is predicted to be of medium negative magnitude and Moderate significance. All other impacts within FL2 are predicted to be between negligible to low negative magnitude and between Negligible and Minor significance.

Section FL3

40.5.86 Potential construction impacts would include fragmentation/isolation, disturbance and pollution due to accidental spills at Harecraig (F18 and F19) and Strannog Hill (F23 and F25). These areas are all assessed as being of county importance for breeding birds. The potential impacts have been assessed as low magnitude and Minor significance. The exception is the risk from pollution which has been assessed as being of medium negative magnitude and Moderate significance. All other impacts within FL3 are predicted to be between negligible to low negative magnitude and between Negligible and Minor significance.

40.5.87 During the operation of the road, impacts from direct mortality, fragmentation/ isolation, disturbance, habitat loss and pollution due to runoff have been identified , particularly at Harecraig and Strannog Hill (both of county importance). These impacts have been assessed as low negative magnitude and Minor significance. The exception is the risk of pollution which has been assessed as medium negative magnitude and Moderate significance. All other impacts within FL1

are predicted to be between negligible to low negative magnitude and between Negligible and Minor significance.

Otters

Direct Mortality

40.5.88 Otters are inquisitive animals and may be attracted onto work sites during the construction phase to investigate new machinery or spoil heaps (Highways Agency 1999). Otters therefore risk becoming trapped in any pits, piping, chemical containers or wire mesh. As otters are largely nocturnal, any night works may also lead to otters being run-over by works vehicles. Such events are not common (Grogan et al., 2001), but the otter's status as an internationally protected species means that any direct mortality caused by the construction of the proposed scheme would constitute an offence.

40.5.89 The principal cause of direct mortality resulting from operation of the proposed scheme would likely be otters being struck by vehicles as they attempt to cross the new road. Otters are highly susceptible to being killed on existing roads, with 60% of all recorded violent deaths in the UK being attributed to road accidents (Woodroffe 2001). Trunk and A-roads account for 57% of these RTAs, although they comprise only 13% of the road network (Philcox et al., 1999). The majority of road casualties (over 50%) occur within 100m of a watercourse (Highways Agency, 1999).

40.5.90 These frequently occur during high water levels. In periods of flood, otters are reluctant or unable to swim under a bridge or through a culvert due to strong currents and high flows. This is exacerbated where there is no ledge above the high water level for otters to walk along. Where otters do attempt to swim under the road during strong currents, they are liable to drown, especially in culverts that have become blocked at one end or where there is a lack of air space. RTAs may be increased where drainage ditches and burns run alongside the road, as otters can be attracted onto the carriageway (Grogan et al., 2001).

Habitat Loss

40.5.91 Impacts associated with the construction of the proposed scheme include loss of habitat due to the siting of works compounds, storage of materials and access roads. The otter is a secretive mammal and as such, holts and couches are very important. Each individual is familiar with its home range, knowing each site where shelter is available. The loss of holts and other lying-up sites would therefore place more stress on the animal, requiring it to travel farther in order to find suitable cover. This may create conflict between otters, particularly where they exist at high otter population densities (e.g. in Aberdeen), or put them at risk to other hazards such as RTAs (Highways Agency, 1999). This would constitute an offence under UK and European legislation. The impacts associated with the construction phase are regarded as being potentially significant where large areas of land adjacent to watercourses are taken up by the presence of compounds, especially where junctions and bridges are proposed.

Habitat Fragmentation and Isolation

40.5.92 Construction of the proposed scheme would necessitate the provision of construction compounds, storage facilities and access roads. These may prevent otters from moving freely within and between existing areas of habitat, particularly where they are situated in the vicinity of watercourses. The construction of culverts on some watercourses may act as a barrier to migratory fish movements, and has the potential to reduce fish populations. Reduction in prey numbers would render upper reaches of these burns of limited use to foraging otters, with potentially significant impacts on their suitability for foraging otters.

40.5.93 The operational scheme would result in habitat fragmentation and form a physical barrier to otters, preventing them from moving freely within and between available areas of habitat. The proposed scheme is predicted to divide otters' home ranges, possibly causing them to abandon parts of their range or to attempt frequent road crossings – with the associated risk of RTAs as otters attempt to

reach foraging and lying-up areas. Severance of an otter's home range may also place it in direct competition with other otters, thus increasing stress within the metapopulation. Otters are capable of inflicting serious and potentially fatal injuries on each other during disputes over territory (Grogan et al., 2001). The proposed scheme may also restrict immigration and emigration, thus decreasing genetic dispersal and increasing competition amongst currently stable populations. These impacts could be damaging to the population, removing animals that may have successfully colonised new areas in the catchment, and affecting breeding.

Disturbance

40.5.94 Otters are likely to suffer increased disturbance during both construction and operation of the new road. Construction of the proposed scheme would be likely to create physical disturbance that could affect the activities of otters. Noise from machinery and vehicles, light for night working, the possible obstruction of holts and otter pathways and the presence of humans can all have adverse impacts. The inappropriate siting of construction compounds or storage sites during the construction phase (e.g. close to lying-up sites) could exacerbate potential impacts. Under current legislation, it is an offence if construction works obstruct access to a holt, disturb an otter in a holt or damage/destroy a holt or couch. Otters may attempt to avoid any periodic disturbance, which would act as a barrier to their usual activities and deter them from using these lying-up sites. This may cause otters to use different routes that may bring them into conflict with other otters or they may use a route that involves crossing other roads, with associated RTA risk.

40.5.95 During the operational phase, otters would be likely to suffer disturbance from traffic noise as well as from road lighting. Otters may become accustomed to these impacts over time (for instance, they commonly use the River Don in Aberdeen city, e.g. at Bridge of Balgownie), but otters could abandon any holts or couches in the immediate vicinity of the scheme.

Pollution and Other Indirect Impacts

40.5.96 Pollution of watercourses and water features in the area could result in serious long-term damage to the productivity and diversity of nearby habitats, having an adverse impact on both otters and their food supply. The construction of bridges and culverts as part of the road scheme may cause restrictions in river and stream channels, which could cause scouring and flooding, cumulating in sediment deposition downstream and a reduction in aquatic invertebrate numbers (Grogan et al., 2001). This would have an adverse impact on fish populations, which in turn could affect otter prey availability. The damage or destruction of salmonid redds is also possible during construction and this could have equally damaging repercussions on the otter population (see Freshwater Ecology Report A40.9).

40.5.97 Being large carnivores, otters are particularly vulnerable to changes in food availability at all levels of the food chain. A pollution event would be particularly serious if it were to occur on one of the larger rivers such as the River Dee or Don. The rivers have large fish populations (and eel populations in the River Don) and otter use of land and burns in the vicinity of the rivers was high during the surveys. Pollutants such as oil and diesel can also affect thermo-regulation qualities of an otter's coat and cause mortality (Kruuk 1995, Grogan et al., 2001).

40.5.98 Pollution from roads can be particularly significant during occurrences of storm water runoff or accidental spillage. Runoff from the operational road may contain compounds used in the manufacture of cars including zinc, cadmium and copper. Compounds such as Polychlorinated Biphenols (PCBs) may also be present and these have the potential to seriously affect the reproduction of otters (Kruuk, 1995).

Specific Impacts

40.5.99 The construction of the road would likely have impacts on otters wherever site compounds and access roads would be located near to watercourses. This is of particular concern where otters and their lying up sites are likely to be disturbed, or the accessibility of foraging and lying up resources would be altered.

40.5.100 Most impacts would be associated with the operation of the proposed scheme. Direct mortality caused by road accidents is the greatest cause of recorded otter mortality in the UK, and without mitigation measures being put in place, comparatively more otters may be killed on roads than at present with impacts on otters at all geographical levels. Pollution incidents resulting from the proposed scheme (see Freshwater Ecology Report in Appendix A40.9) also have the potential to result in changes to the local population, particularly if a serious pollution incident occurred.

Section FL1

40.5.101 Crossings and culverts are proposed at Megray Burn, the upper reaches of Limpet Burn and Green Burn. The potential for increased risk of direct mortality during construction of these crossings is assessed as a high negative impact of Moderate significance at Megray and Green Burns and a high negative impact of Major significance at regionally important Limpet Burn. The extensive realignment of Megray Burn and the construction of a buried structure at Limpet Burn along a high value riparian strip would be likely to cause additional disturbance, which would result in high negative impacts of Moderate and Major significance at Megray Burn and Limpet Burn respectively.

40.5.102 In addition, temporary severance of a commuting route at Limpet Burn would occur if there were no provision for otters to pass through during the construction of the buried structure. This would result in a high negative impact of Major significance as this would affect the availability of resources either side of the road.

40.5.103 The increased risk of direct mortality during the operational scheme due to RTAs or drowning in culverts is likely to be an impact of high negative magnitude of Moderate significance at Megray and Green Burns. The loss of foraging habitat and cover, in addition to burn realignment, would be likely to have a significant impact on the suitability of these burns as a foraging resource. These impacts are also considered to be of Moderate significance.

40.5.104 The effects of severance at Green Burn would be predicted to be of high negative and Moderate adverse significance. The presence of two culverts may prevent otters from using the burn to reach potential lying up habitat at Fishermyre, as well as the road acting as a barrier between upstream and downstream resources including Coneyhatch Burn and Fishermyre Pond to the west. Disturbance of foraging and commuting otters as a result of junction lighting at Megray Burn and also of otters using Fishermyre Moss for breeding and lying-up is predicted to be impact of medium negative magnitude and Moderate significance. Potential pollution due to runoff from the road would potentially constitute a high negative impact on all three burns. This impact is assessed as being of Moderate significance for Megray and Green Burns and of Major significance for regionally important Limpet Burn.

Section FL2

40.5.105 A crossing involving a buried structure is proposed at the Burn of Muchalls. The increased risk of direct mortality and disturbance as a result of construction works alongside the burn are considered to be of high negative magnitude and Major significance. Further disturbance impacts are predicted along Back Burn which are assessed as being of medium negative magnitude and Moderate significance. The construction of the buried structure at the Burn of Muchalls would cause severance of the burn along an important commuting route if otters could not move freely below the road during construction. This would constitute an impact of high negative magnitude and Major significance if resources either side of the road were made unavailable during this period or if otter territories were severed.

40.5.106 The permanent loss of high value habitat including potential lying-up and foraging habitat at the Burn of Muchalls is considered an impact of medium negative magnitude and Major significance, as it may result in the displacement of otters (potentially breeding otters) in the area. Similarly, the loss of potential lying up sites including potential couch C4 due to disturbance and severance would be a high negative magnitude impact of Major significance. Although the scheme would not cross Back Burn, it would pass 50m to it and therefore disturbance impacts are assessed as having medium negative magnitude and Moderate significance

40.5.107 Disturbance along the Burn of Muchalls, in particular if the behaviour and territory structure of adult and juvenile otters were affected, as a result of the operation of the scheme, would be predicted to result in an impact of medium negative magnitude and Major significance if the suitability of the burn to support otters were reduced.

40.5.108 Pollution due to particulate matter from the operational scheme would constitute impacts of high negative magnitude and Major significance along the Burn of Muchalls due to downstream impacts on an area potentially used for foraging during the raising of young.

Section FL3

40.5.109 The scheme would cross Balnagubs Burn, the Burn of Elsick, Whiteside Burn and Crossley Burn via culverts. There would also be a risk of direct mortality and disturbance during construction, including the destruction of a potential couch (C10) where the proposed scheme crosses Crossley Burn. These impacts are considered to be of high negative magnitude and Moderate significance at Balnagubs Burn and Crossley Burn and of Major significance at regionally important Burn of Elsick.

40.5.110 During the operational scheme, the increased risk of direct mortality due to RTAs or drowning in culverts would constitute a high negative impact of Moderate significance at Balnagubs Burn and Crossley Burn and of Major significance at the Burn of Elsick. Loss of medium value riparian scrub habitat is assessed as a medium negative impact of Moderate significance at Balnagubs Burn and the Burn of Elsick. Furthermore, impacts of medium negative magnitude and Moderate significance are predicted due to habitat fragmentation. The scheme would act as a barrier, severing otter commuting routes in the area.

40.5.111 Pollution impacts are predicted to be of medium negative magnitude and Moderate significance where the scheme crosses Balnagubs Burn and the Burn of Elsick. The potential downstream impacts of a pollution incident would be likely to result in substantial changes to the suitability of these watercourses and associated tributaries as a foraging resource, although this would be unlikely to permanently affect the integrity of the burn to support otters.

Red Squirrels

40.5.112 According to the Scottish Strategy for Red Squirrel Conservation (2004), the precise reasons for the decline of the red squirrel are unknown, but both changes in woodland habitat and road kills have been identified as likely factors.

40.5.113 Red Squirrels and their dreys are protected under the Wildlife and Countryside Act 1981 and the Nature Conservation (Scotland) Act 2004. Refer to paragraph 40.3.78.

Direct Mortality

40.5.114 Direct mortality due to construction of the proposed scheme could represent a key impact in areas where red squirrels are present. They could suffer direct mortality during construction through tree felling, or by works traffic clearing the site, or indirect mortality through stress.

40.5.115 Red squirrels may attempt to cross the carriageway during the operational phase of the proposed scheme, and therefore be at increased risk of mortality resulting from traffic. Mortality may increase in areas where the carriageway either fragments or isolates areas of woodland. This impact could affect a high proportion of the local population. For example, according to the North Merseyside Action Plan for red squirrels, up to 50 animals per year have been killed in the Formby area of North Merseyside alone (Highways Agency BAP, undated).

Habitat Loss

40.5.116 The loss of woodland habitat due to the proposed scheme may represent a substantial loss of red squirrel breeding and foraging habitat, and also affect the long-term viability of woodland areas to

support red squirrels. Red squirrels can be prone to starvation, and any reduction in habitat may decrease the available food supply and increase the likelihood of starvation (Gurnell, 1987). The presence of a mixture of coniferous tree species (Scot's pine, Douglas fir, European larch and Norway spruce) means that red squirrels can forage throughout the year and the loss of any one of these tree species may lead to a gap in foraging opportunities for red squirrel. In addition, edge effects of the rproposed scheme, resulting from noise, disturbance and pollution, may result in the abandonment of a greater area of woodland by red squirrels than that lost directly by the footprint of the road.

Habitat Fragmentation and Isolation

40.5.117 Where the proposed scheme either fragments or isolates woodland, there may be an impact on the long-term genetic diversity of the local red squirrel population. This barrier may cut off populations by restricting movement of red squirrels, either during population dispersal, during the breeding season or when red squirrels are foraging throughout their range. Red squirrels are likely to become stressed by any disruption to or change in their home range. There is also the potential for cumulative impact of further development on those red squirrels isolated on the eastern side of the road.

Disturbance

40.5.118 Disturbance due to construction operations may represent a main impact in areas where red squirrels are present. Noise from machinery and vehicles, light for night working, dust and the presence of humans can all have adverse effects.

40.5.119 During the operational phase of the proposed scheme, red squirrels are likely to suffer disturbance from traffic noise as well as from road lighting. This disturbance would probably increase with proximity to the proposed scheme, and may prompt squirrels to move away from the carriageway to forage and/or breed. This may expose both migrant squirrels and any resident red squirrels in areas farther away from the road to increased levels of stress, intra- and inter-specific competition and starvation, due to increased pressure for limited resources.

Specific Impacts

40.5.120 The specific impacts associated with the construction and operational phases of the proposed scheme on local red squirrel populations at specific locations within Sections FL1 to FL3 are summarised below.

Section FL 1

40.5.121 No impacts on red squirrels of Moderate or greater significance are predicted to occur in Megray Wood. The other woodland areas surveyed in this section (Limpet Burn Wood, Fishermyre Wood and North Fishermyre Wood) are considered to provide low value habitat for red squirrels and furthermore, no signs of red squirrel presence was evident. As such, no impacts are predicted in these areas.

Section FL 2

40.5.122 No suitable areas of red squirrel habitat have been identified in this section and therefore no impacts are predicted.

Section FL 3

40.5.123 No impacts have been predicted for red squirrels this section, due to the distance of East Crossley Wood and Craigentath Wood from the proposed scheme.

<u>Water Vole</u>

40.5.124 Assessments of impacts of the proposed scheme on water vole address potential impacts that may affect all water vole populations in the vicinity of the scheme. There is potential for the water vole population at Fishermyre Moss to expand as far north as Back Burn (waterbody 10) and as far south as Megray Burn (waterbody 1). Beyond these limits, it is assumed to be highly unlikely that any waterbodies would be colonised by water voles and that there would be no impact on water voles any farther north than Back Burn. The assessment therefore only examines impacts that could potentially affect Waterbodies 1-10.

Generic Impacts

Direct Mortality

40.5.125 Water voles are strongly associated with their burrow systems and nests. In response to any disturbance, water voles seek refuge within their burrow systems. During construction, this would leave them liable to direct mortality when works to clear any ditch systems or re-profile any waterbodies may result in the destruction of burrow systems and the death of any water voles inside. Likewise any works to clear or drain any areas of wetland may result in water voles being crushed by works vehicles. Any works which could cause vibrations in the vicinity of water vole burrows (e.g. bore hole operations or the movement of heavy vehicles) may cause burrow systems to collapse leading to further direct mortality. The current alignment may result in the direct mortality of water voles using waterbodies 4, 5, 6 and 7 (Coneyhatch Burn and drains at Coneyhatch Farm and Fishermyre Farm, Green Burn, drains at Fishermyre Moss and Fishermyre Moss).

40.5.126 Water voles may become trapped within any lengths of narrow pipe, containers or wire mesh associated with the construction of the proposed scheme. There would be a greater risk of this occurring where such items have been discarded in areas of tall vegetation or marshland, or in drainage ditches.

40.5.127 During operation, where the road crosses drainage ditches and burns, it may be necessary to culvert these waterbodies. Inappropriate design of culvert may result in fast flows of water or a lack of air space, particularly during flood events. Any water voles attempting to swim under the road in such conditions may drown or be swept away.

40.5.128 Water voles normally avoid areas of open ground, as they perceive a greater risk of predation in such areas (Carter and Bright, 2003; Dean, 2003). Therefore, it is unlikely that water voles would attempt to cross the carriageway itself and suffer any mortality through being run over.

Habitat Loss

40.5.129 During construction, loss of habitat may result from the inappropriate siting of temporary works compounds, balancing ponds, storage of materials and temporary site access roads.

40.5.130 During operation, loss of habitat may result in a loss of both existing and potential water vole habitat, where the road crosses and/or runs close to waterbodies. Loss of habitat has been one of the main factors that have contributed to the water vole's decline over the last century (Strachan and Jefferies, 1993). The reckless destruction of water vole burrows is an offence under the Wildlife and Countryside Act (1981) (as amended).

40.5.131 The installation of culverts and/or the realignment of watercourses or destruction of watercourses (in the case of some drainage ditches) would result in a loss of and degradation of habitat. The culverted sections of watercourses would lack riparian vegetation and soft banks and may not be used due to water vole's increased perception of predation risk (Carter and Bright, 2003). Poorly designed realignments, where waterbodies are either canalised, too steep or constructed of manmade materials, may be unsuitable for water voles due to lack of suitable vegetation, high flow rates or unsuitable burrowing habitat.

40.5.132 The proposed scheme may result in further habitat loss where it has an impact upon the local hydrology of an area. Impacts to ground water flow or disturbance to surface runoff may result in some areas of wetland or drainage ditches drying out or result in flooding. Fluctuations to water levels can reduce the availability of cover, burrowing habitat and food resources to water voles (WildCRU, Oxford University 2004; Strachan 1998). Inappropriate design of bridges and culverts may cause restrictions in the watercourse channels, which can cause scouring and flooding, leading to sediment deposition and the silting up of waterbodies (Grogan et al., 2001).

40.5.133 The edge effects of the proposed scheme may increase the overall habitat loss associated with the road as spray and road runoff could have impacts upon soils in adjacent habitat, making them unsuitable for wetland plant species. Additional habitat loss may occur where drainage ditches or areas of wetland lie beneath the footprint of the proposed scheme.

40.5.134 The current alignment may result in water vole habitat loss at waterbodies 4, 6, and 7 (Coneyhatch Burn and drains at Coneyhatch Farm and Fishermyre Farm, drains at Fishermyre Moss and Fishermyre Moss).

Severance and Habitat Fragmentation

40.5.135 Culverted watercourses are unlikely to be frequently used by water voles as the culverted reaches would offer long sections (70-200m) of bare habitat where water voles will perceive a high risk of predation (Carter and Bright 2003). Water voles would not attempt to cross the carriageway itself for the same reasons. Therefore, the road would provide an effective barrier to movements of water voles from one side of the road to the other and would fragment the water vole population where it separates colonies from one another. This would have two effects on the local water vole population. The first would be to prevent water voles dispersing and colonising new or previously occupied areas. The second would be to prevent water voles from interacting with neighbouring water vole colonies separated from one another by the road. Both of these effects would increase the potential for the local water vole population as a whole to become extinct. It is important for the viability of small, fragmented populations of water voles, such as the one present within the study area, to be able to maintain genetic variance through interactions between local colonies and to be able to colonise unoccupied suitable areas of habitat as and when they become available. If a large proportion of the overall population is limited to a single colony, in a small patch of suitable habitat, then there is an increased probability of a high percentage of the entire population being wiped out through a single stochastic event.

40.5.136 As well as fragmenting water vole populations, the road may lead to the fragmentation of water vole habitat. This could render some areas of habitat unviable in terms of their ability to function as a resource for water voles. Fragmented lengths of ditch or wetland may be unsuitable habitat for water voles as they may become too small to offer sufficient food or burrowing habitat to any water voles present. The effects of fragmented habitat would also add to the overall effects of habitat loss.

Disturbance

40.5.137 During construction, any works taking place within 20m of a water vole colony may disturb water voles. Levels of disturbance would depend upon what works were taking place, e.g. the use of loud machinery 20m from the channel or works within the affected waterbody is likely to cause a greater disturbance than hand digging 10m from the channel. Disturbed voles may forage less, seeking refuge in burrow systems.

40.5.138 Disturbance during operation of the proposed scheme is unlikely to have an impact upon water voles.

Pollution

40.5.139 During construction, any spillages into waterbodies or wetlands of cement, petrochemicals, lubricants, solvents, etc, used for plant and general works during the construction of the road may harm both water voles and the vegetation and water quality of their habitat.

40.5.140 Where road construction takes place close to a waterbody, excessive dust or earth is released into the waterbody. This may add to the degradation of water vole habitat.

40.5.141 During operation, runoff from the road may contain toxic chemicals such as zinc, cadmium and copper. Compounds such as PCBs may also be present, which have the potential to affect mammalian reproductive rates (Grogan et al., 2001). Further details regarding generic impacts of Pollution can be found in Chapter 39 (Water Environment) and in the Freshwater Ecology in Appendix A40.9.

Specific Impacts

40.5.142 Potential impacts from the scheme could affect the water vole population in Section FL1 in two ways. The first is through placing limits upon the ability of existing water vole populations to expand their range in the future. The second is through affecting the existing water vole population identified at Fishermyre Moss (waterbodies 4-8). The potential impacts of the scheme that would affect the likely survival of the identified water vole colonies at a local scale could, in turn, affect the survival of the local water vole population as a whole.

40.5.143 During the construction phase, there would be an increased risk of direct mortality attributable to the destruction of burrows or nests potentially containing water voles where the road alignment severs water features/wetlands known to contain water voles. There would also be an increased risk of direct mortality during the operational scheme should the culvert proposed for ch3125 be of unsuitable for water vole use. The current alignment would result in the severance of water vole colonies and habitat at waterbodies 5 and 6 (Green Burn and within Fishermyre Moss) from colonies at waterbodies 7 and 8 (Fishermyre Moss and Fishermyre Pond). The alignment would provide a barrier to the future colonisation of water bodies 1 to 4 (Megray Burn, Limpet Burn and Coneyhatch Burn and drains at Coneyhatch Farm and Fishermyre Farm). This would also result in fragmentation of waterbodies 4, 6 and 7 (Coneyhatch Burn, drains at Coneyhatch Farm and Fishermyre Farm, drains at Fishermyre Moss). Direct loss of suitable water vole habitat would occur at the above watercourses/bodies due to landtake of the proposed road and could potentially lead to further loss of water vole wetland habitat should the local hydrology be altered during road construction and operation. All the above impacts are assessed as being of high negative magnitude and Major significance.

<u>Water Shrew</u>

40.5.144 There are many aspects of road construction and operation that can have adverse impacts on water shrew populations. The DMRB (Highways Agency 2001) identifies the potential impacts that road developments may have on water shrews, which are discussed below. As water shrew were not found during surveys, but are assumed to be present on most watercourses in the study area, the following discussion describes impacts likely to occur along the proposed route corridor.

Direct Mortality

40.5.145 Water shrew could suffer direct mortality during construction through habitat loss as a result of vegetation removal, during site clearance or through the pollution of watercourses. Water shrew may also become trapped in any small-aperture receptacles left lying around on construction sites, in addition to uncovered pits and trenches. Water shrew would be unlikely to cross the carriageway during the operational phase of the proposed scheme as they are averse to crossing areas of open ground. Therefore, any risk of mortality resulting from traffic is predicted to be low.

Habitat Loss

40.5.146 Habitat loss during construction would likely be widespread and in particular association with the installation of culverts and/or bridges on the majority of watercourses crossed by the proposed scheme. However, it should be noted that the amount of habitat loss would represent a small proportion of suitable water shrew habitat (between 30m and 240m of watercourse habitat depending upon the angle at which the road crosses the watercourse and whether the road is in embankment or cutting). At its greatest, this size of habitat loss is equivalent to the size of one to two water shrew territories on each waterbody.

Habitat Fragmentation and Isolation

40.5.147 Habitat fragmentation, isolation and severance of water shrew populations resulting from habitat loss and in-channel works during the construction of culverts and/or bridges would be likely to occur on affected watercourses. The extent of this impact in terms of a total barrier to movements and/or dispersion would depend on whether effected watercourses were diverted prior to construction.

40.5.148 The proposed scheme during operation would represent a barrier between potential populations either side of the alignment, restricting dispersal of young and the movements of males during the breeding season. Both of these impacts restrict gene flow and could result in the loss of isolated fragments of the water shrew population.

Disturbance

40.5.149 Water shrew populations on watercourses and/or other suitable habitats would be likely to incur considerable disturbance during construction of the proposed scheme. This is mostly associated with pre-construction habitat clearance of proposed watercourse crossings. It is possible that disturbance may result in the redistribution of some water shrew territories, although this would depend on the magnitude of disturbance. Disturbance during operation of the proposed scheme would probably be minimal and mostly associated with routine mowing of roadside verge or clearance to gain maintenance access to culverts and/or bridges.

Pollution

40.5.150 Pollution events could occur during the construction of the road. Potential pollution events include toxic spill events and increased sedimentation of watercourses during the construction of bridges, culverts and watercourse diversions. Increased sedimentation and toxic spills would have an adverse impact on local water shrew populations inhabiting the affected watercourse or connected watercourses, both directly and indirectly through loss of macroinvertebrate prey. Potential impacts during the operation of the proposed scheme would probably include toxic spill events and adverse impacts related to road runoff. Runoff from the road could contain PCBs, heavy metals or oils. Elevated levels of these can affect mammalian reproduction rates, directly poison them, decrease aquatic invertebrate abundance or decrease the waterproofing abilities of the water shrew's coat.

Specific Impacts

Section FL1

40.5.151 Crossings, culverts and channel realignments are proposed for Megray Burn, Limpet Burn and Green Burn. These activities are predicted to increase the risk of direct mortality, result in habitat loss and fragmentation, disturbance and pollution of these watercourses and the adjacent riparian habitat. These areas are of local ecological importance for water shrew and impacts are therefore assessed as being low negative magnitude and of Minor significance.

Section FL2

40.5.152 Disturbance to the Burn of Muchalls and adjacent riparian habitat would occur during the construction and operation of the scheme. However, given the available habitat upstream and downstream, this impact and all others are assessed as being low negative magnitude and of Negligible significance.

Section FL3

40.5.153 The alignment of the proposed scheme would require the crossing of the Burn of Elsick, Whiteside Burn and Crossley Burn. Disturbance and pollution during construction are likely to be low negative impacts of Minor significance. Habitat loss, fragmentation and the risk of direct mortality are predicted to be of low negative magnitude and of Negligible significance. These impacts are not expected to have a long-term effect as it is expected that any resident water shrew populations would disperse to other areas.

Amphibians

Direct Mortality

40.5.154 The risk of direct mortality of amphibian species is highly dependant on the time of year that works are conducted. When amphibian species are in their breeding habitat (early spring/early summer), construction works resulting in destruction or pollution of that waterbody would have the greatest risk of mortality. However, if construction were to take place from late-summer to early spring, mortality would mainly occur to amphibian species in adjacent terrestrial habitats. The risk of mortality would increase the closer the destruction of terrestrial habitat is to a waterbody. If the loss of amphibians is sufficiently high, then amphibian populations could become locally extinct. Any amphibians in close proximity to the waterbody while migrating or feeding could be trampled or killed by the wheels of machinery. During late October to early March, amphibians present in any hibernacula destroyed during site clearance and topsoiling would be killed or die through exposure.

40.5.155 Amphibian mortality on operational roads is most obvious during breeding migrations in the early spring when hundreds of individuals may be lost on a single night within a short stretch of road (Highways Agency, 2001). A study undertaken by SNH (1994) estimated that 20-40% of breeding amphibians are killed each year from RTAs. The impact of such mortality on the wider population would vary according to a range of factors such as the proximity of the road to the breeding site, the proportion of the population that crosses the road and the volume of traffic on the road (Highways Agency, 2001).

Habitat Loss

40.5.156 The direct loss of breeding ponds is the most obvious potential impact on amphibians. Any loss of aquatic habitat can potentially lead to a reduction of breeding habitat, possibly resulting in a localised decrease in breeding success, especially in areas that have a low pond density. In addition, the loss of pond habitats can have severe impacts on the metapopulation structure of amphibians by reducing the density of ponds within an area and isolating potentially non-viable populations.

40.5.157 Terrestrial habitat loss over 250m from a breeding pond is unlikely to have a significant effect on amphibian populations (English Nature, 2001), while Oldham (1994) concluded that blocks of suitable habitat of less than 0.4ha within 250m of a waterbody are unlikely to support a viable population. Valuable amphibian habitat includes semi-improved grassland, scrub and woodland, wet and dry modified bog, swamp, marshy grassland and tall ruderal herb and fern. Loss of this habitat would reduce available refugia, hibernation sites and feeding opportunities and lead to exposure, predation and failure to breed. All of these effects have the potential to reduce recruitment and ultimately population size.

40.5.158 Alteration to natural drainage features (such as seepage lines, burns and springs) and artificial drainage features (such as ditches and land drains) during road construction may have a significant effect on amphibian populations. Water levels in breeding ponds may be critically raised or lowered such that conditions become less suitable or even unsuitable for some amphibian species (Highways Agency, 2001).

Habitat Fragmentation and Isolation

40.5.159 Previous studies have shown roads to be a significant barrier to amphibian dispersal, interrupting migration between terrestrial and aquatic habitats (Voss, 1995). Reduced dispersal between populations can lead to breeding ponds becoming isolated from the terrestrial habitat used by amphibians during non-breeding stages of their life cycle. In addition, the barrier effect of new roads can result in populations becoming isolated, increasing the risk of local extinction and genetic impoverishment (English Nature, 2001). It is possible that amphibian populations living near major roads may be reduced in size dramatically or lost completely after 5-10 years exposure (Highways Agency, 2001).

Disturbance

40.5.160 Artificial lighting has been shown to affect the feeding behaviour of nocturnal frogs, reducing their visual acuity and ability to find prey (Buchan, 1993). It is reasonable to assume that the effect of light disturbance could also affect nocturnal native amphibian species. If roadside lighting at junctions illuminates areas of feeding habitat adjacent to the road then it may constitute a disturbance impact to amphibians.

Pollution and Other Indirect Impacts

40.5.161 Inorganic diffuse runoff from the road could pollute waterbodies, adversely affecting amphibian populations. The use of salt to de-ice roads in winter may have adverse impacts on amphibians in areas close to the road. There is also the potential for sediment runoff to block rain seepage lines and alter the depth and size of the pond, adversely affecting resident amphibian populations.

Specific Impacts

Section FL1

40.5.162 The operational scheme is predicted to result in the direct mortality of amphibians in Habitat Area F10 and disturbance, habitat loss and fragmentation of amphibian terrestrial habitat within areas F6, F7, F8, F10, F11 and F12, which are of local ecological importance. These impacts are assessed as being low negative impacts of Minor significance. The potential for pollution of Fishermyre Pond (E) and the surrounding terrestrial habitat during construction or operation is assessed as being a low negative impact of Minor significance.

Section FL2

40.5.163 The operational scheme is likely to result in habitat loss and fragmentation, disturbance and pollution within Habitat Area F15. Impacts on both ponds in this Habitat Area are assessed as being low negative of Minor significance. Habitat Areas F14 and F16 are of less than local ecological importance and are far enough from the alignment that any impacts are anticipated to be low negative of Negligible significance.

Section FL3

40.5.164 The main potential impact on amphibians in Section FL3 is predicted to from the fragmentation of available terrestrial habitat. Minimal habitat loss is anticipated, although the alignment would fragment Habitat Area F23. The scheme would also act as a physical barrier, preventing dispersal from one side to the other. For example, Habitat Areas F17 and F19 would become isolated from each other, as the completed road would stop dispersal between them. These areas are of local

importance and the fragmentation is assessed as being a low negative impact of Minor Significance. Direct mortality, habitat loss, disturbance and pollution are predicted to be low negative impacts of Minor significance.

Brown Hare

40.5.165 Brown hare are assumed to occur in low numbers throughout the study area, with the exception of F18, where the population is larger due to the provision of foraging and shelter from areas of marshy grassland and scattered scrub along field boundaries.

Direct Mortality

40.5.166 Construction of the proposed scheme would necessitate the removal of vegetated areas and the clearance of soil using machinery and during this process hare mortality is possible. Leverets would be particularly susceptible to these activities as they are left alone in forms during the day and may be reluctant to move from their places of refuge (Hutchings and Harris, 1996; The Game Conservancy Trust, 2002). There is also the potential for hares to be killed through becoming trapped in any pits, piping, chemical containers or wire mesh associated with construction activities. However, significant numbers of hares are unlikely to be killed as a result of these activities. During operation of the road, there is a risk of hare RTAs as hares attempt to cross the carriageway, particularly in areas where suitable habitats are severed.

Habitat Loss

40.5.167 Areas of rough grassland, arable land, scrub and woodland that are important to hares would be lost to the proposed scheme. There is however, ample medium value hare habitat in the study area and this impact is not considered to be of great importance.

Habitat Fragmentation and Isolation

40.5.168 The operational road would represent a barrier between potential hare populations either side of the alignment, which would restrict the movement of hares in and between available habitats. The operational road may also restrict immigration and emigration, thus decreasing genetic diversity and increasing competition among stable populations

Disturbance

40.5.169 Hares are likely to be disturbed by the construction of the proposed scheme. Noise from machinery, vehicles and the presence of humans may adversely affect hares, especially breeding females (Tapper and Hobson, 2002). The noise of vehicles during operation may adversely affect hares in the short term, however, in certain areas habituation to the noise would be likely to occur in the medium term.

Specific Impacts

40.5.170 Potential impacts of the proposed scheme on the local hare population would be associated with the operation of the road, particularly the resultant habitat loss, fragmentation and isolation of brown hare habitat within F18. The proposed scheme would sever marshy grassland and semi-improved fields, which support brown hare populations, and would thus act as a barrier restricting movement of brown hare within their home range.

40.5.171 The severance of agricultural land in F18 would adversely affect the resident brown hare populations, the impact of which has been evaluated as of low negative magnitude and Minor significance. Throughout the other Habitat Areas, impacts on brown hare populations have been evaluated as being of Negligible significance.

Reptiles

Direct Mortality

40.5.172 Reptile mortality may occur during the construction phase of the road, through site clearance and excavations as well as being run-over by construction vehicles. This would constitute an offence under the Wildlife and Countryside Act (1981) (as amended). During the operational phase, there would be the potential for mortality through reptiles basking on the roadside or attempting to cross the road and subsequently being run-over.

Habitat Loss

40.5.173 Habitat loss would probably have an adverse impact on reptiles where the construction of the proposed scheme would result in the destruction of areas supporting suitable reptile habitat. Temporary habitat loss could also occur through the siting of compounds and storage areas associated with the construction phase of the road.

Habitat Fragmentation and Isolation

40.5.174 Construction of the road would potentially result in areas of suitable reptile habitat being severed, fragmenting and isolating any remaining potential reptile populations. Temporary habitat fragmentation and isolation may occur through the siting of construction compounds.

40.5.175 Operation of the proposed scheme is predicted to restrict dispersal and may act as a barrier to the colonisation of new areas during operation, which in turn may reduce the genetic diversity of reptile populations, making them more vulnerable to stochastic events.

Disturbance

40.5.176 During the construction phase of the proposed scheme, vibrations from machinery and large vehicles would probably disturb reptiles and deter them from residing in habitats adjacent to the areas of proposed scheme. The storage of construction materials in sensitive areas, in addition to removing debris such as logs and rubble, could also constitute disturbance to reptiles, the effects of which could be particularly detrimental if carried out during the breeding season or when reptiles are hibernating.

Specific Impacts

Section FL1

40.5.177 There is extensive reptile habitat in this section and an incidental recording of a common lizard confirms its suitability. The proposed scheme is predicted to result in direct mortality, habitat loss and fragmentation, disturbance and pollution within Habitat Areas F7, F10 and F12. These areas are of local ecological value for reptiles and these impacts are assessed as being low negative impacts of Minor significance.

Section FL2

40.5.178 In this section, the potential impacts associated with the construction and operation of the proposed scheme are fragmentation and disturbance of Habitat Area F15. The road would act as a physical barrier to reptiles and prevent them crossing from one side to the other. These are assessed as being low negative impacts of Minor significance. Direct mortality, habitat loss and pollution are also considered low negative impacts of Minor significance.

Section FL3

40.5.179 In Section FL3, the proposed scheme would fragment the habitat in F21, rendering the remnant pieces of habitat of almost no value to reptiles due to their smaller size. The reptile habitat in this Habitat Area is of less than local importance due to its relatively small size, therefore this impact is low negative and of Negligible significance. Other impacts in this section include direct mortality, habitat loss, fragmentation, disturbance and pollution of Habitat Area F23. This is of local ecological importance and these impacts are assessed as being low negative magnitude and Minor significance. Habitat Areas F17 and F19 would be isolated from each other by the road, presenting a physical barrier to reptile distribution. These areas are also of local ecological importance and this impact is assessed as low negative of Minor significance.

Terrestrial Invertebrates

40.5.180 Impacts on terrestrial invertebrates are predicted to occur along the length of the proposed scheme. The following provides a discussion on the likely predicted impacts.

Direct Mortality

40.5.181 Work during the construction phase involving large earthworks and heavy machinery would result in the death of a range of ground dwelling invertebrates, particularly slower moving, flightless arthropods, which cannot avoid being crushed by construction machinery. This is unlikely however, to permanently affect the population dynamics of any community.

40.5.182 Direct mortality resulting from operation of the scheme is likely to impact invertebrates as a result of an increased risk of being crushed or impacted by vehicles. Although there are no peer reviewed research, roadkill is known to have a major impact on roadside invertebrate populations (Oxley and Fenton, 1974; Mader, 1984). The only survey conducted to date in the UK was undertaken by the RSPB in 2004 (www.rspb.org.uk/bugcount). This study documented that invertebrate mortality is a common occurance on British roads. This impact is unlikely, however, to permanently affect the local population dynamics.

Habitat Loss

40.5.183 The proposed scheme would result in direct loss of habitat. Although the lost habitat would likely maintain several populations of nationally important species, only a small loss of the total available habitat is predicted.

Habitat Fragmentation and Isolation

40.5.184 In addition to the physical barrier that would be created after the scheme is built, there would also be habitat fragmentation and isolation through the provision for construction compounds, storage facilities and access roads. Although many invertebrates do not travel large distances, this fragmentation and isolation has the potential to have an impact upon small-scale population dynamics, but only in localised areas.

40.5.185 Large roads are absolute barriers to gene flow as shown in forest Carabid populations (Keller and Largiader, 2003) and in land snails that would not cross even un-paved roads as narrow as 3m (Baur and Baur, 1990). The operational scheme would also result in habitat fragmentation to those invertebrates that attempt to cross the road but suffer mortality. The road may also restrict immigration and emigration in certain species groups, thus decreasing genetic dispersal and increasing competition amongst currently stable populations. The operational impact has the potential to affect small-scale population dynamics, but only in localised areas.

Disturbance

40.5.186 During the operational phase, there is predicted to be considerable disturbance as a result of verge mowing and other maintenance works. Frequent mowing along verges disturbs invertebrates and leads to a loss of over-wintering habitat. The result of shortened vegetation is generally a reduction in the abundance and diversity of most groups and species (Morris, 2000). This disturbance favours a few opportunistic and robust species, often non-native, to the detriment of those that are slower to adapt (Mader, 1984; Hollifield and Dimmick, 1995; Haskell, 2000). The potential risk of extinction of local ground dwelling invertebrates therefore increases.

Pollution and Other Indirect Impacts

40.5.187 Activities associated with road construction can cause soil compaction, which reduces the presence of terrestrial niches and leads to increased runoff and decreased soil porosity, therefore causing soil dwelling invertebrate mortality (Noss, 1995).

40.5.188 During operation, in addition to destroying invertebrate habitat on the area used for the road itself, there would be a reduction in the quality of habitat on road verges through the alteration of vegetation, changing of soil dynamics and modification of microclimates.

40.5.189 De-icing salts cause saline pollution from particularly sodium chloride but also magnesium chloride, and calcium chloride. This may cause invertebrate mortality from desiccation. These salts also produce ions, which alter the soil pH and therefore change the plant communities, which could be detrimental to the invertebrates using this vegetation as habitat.

40.5.190 Runoff from the operational road may contain compounds used in the manufacture of cars including zinc, cadmium and copper. Petroleum products also include heavy metals that could contribute to invertebrate mortality. Earthworms are known to bio-accumulate heavy metals, which would then be passed up the food chain.

40.5.191 Road surfaces tend to absorb solar radiation at a higher rate than natural surfaces, increasing soil and air temperatures (Haskell, 2000). This increased aridity has been known to decrease invertebrate diversity (Grindal and Brigham, 1998).

Specific Impacts

40.5.192 As invertebrates are widespread throughout the proposed scheme, the potential impacts described above would be likely to occur across the scheme. Direct mortality of terrestrial invertebrates during both construction and operation of the proposed scheme is unlikely to permanently affect the population dynamics of local communities and so is considered to be of negligible magnitude and Negligible significance. Only a small loss of the total available habitat is predicted under the current proposals and therefore this impact is assessed as being of low negative magnitude and Minor significance. Fragmentation, isolation and disturbance have the potential to have an impact upon small-scale population dynamics, but only in localised areas. Therefore, these impacts are considered to have negligible magnitude and be of Negligible significance during construction and operation. Similarly, impacts of Negligible significance are also predicted as a result of pollution and the other indirect impacts discussed above.

40.5.193 Although no areas were assessed as being above local importance to invertebrates, two specific potential impacts are predicted for Section FL1. In F10 and F12 (Fishermyre Wood south and Fishermyre Wood), changes to the vegetation species composition and the microhabitats available for invertebrates area could occur where potential hydrological impacts on wetland habitats are predicted. As the scheme has been designed to minimise alterations to local hydrological conditions, this impact is predicted to be of Minor significance.

40.5.194 In Megray Wood, Limpet Burn and Fishermyre Wood (F6, F7 and F12, respectively) habitat loss and severance would constitute adverse impacts on invertebrates. These would occur through the

loss of valuable habitat at these key sites and through a barrier to dispersal between high quality habitat fragments in this area. This impact would is considered to be of low negative magnitude and would therefore be of Minor significance.

Freshwater Habitat

40.5.195 The following discussion addresses potential impacts on the freshwater environment including macroinvertebrates, aquatic habitat and fish.

Point Source and/or Diffuse Organic/Inorganic Pollution

40.5.196 During construction of the proposed scheme there is potential for accidental pollution release to adjacent waterways including oil and fuel from plant, liquid concrete, uncontrolled sewage release and fine sediment release (see below). The effect of any given pollution event is likely to have greater impacts in smaller watercourses, which have lower dilution.

40.5.197 Oils, fuels and chemicals can enter watercourses via accidental spillage from storage tanks or leakage from mobile or stationary plant. Oils can form a film on the water surface resulting in an adverse effect on water quality. These oils can interfere with the gills of invertebrates and fish and inorganic pollutants may have a lethal effect on aquatic flora and fauna.

40.5.198 Concrete, cement and admixtures could be released to watercourses through accidental spills or from the washings of plant and machinery. Concrete and cement are highly alkaline and may adversely affect aquatic organisms if the pH is elevated to or maintained above 8.5.

40.5.199 Accidental/uncontrolled release of sewage could result from damage to pipelines during service diversion. Release of sewage to watercourses would result in organic loading and could lead to increased biological oxygen demand and decreases in dissolved oxygen.

40.5.200 Without appropriate mitigation, operational road runoff and accidental spills from traffic would raise levels of pollutants entering the watercourses. This would lead to decreased macroinvertebrate species richness through the loss of pollution sensitive/rare species and ultimately lead to fish kills if toxicity reaches lethal levels.

Increased Sediment Loading and Changes to Sediment Transport

40.5.201 During construction, increased sediment loading to adjacent watercourses could occur in the absence of suitable mitigation. Suspended solids can result from excavations, runoff from stockpiles, plant and wheel washing, runoff from site roads, runoff during embankment construction, earthworks and landscaping. The risk of release of suspended solids into watercourses or drainage ditches is greatest at road crossings where earthworks would be involved in the construction of culverts, bridges and river diversions. Changes in water velocities resulting from temporary stream diversions during construction are also predicted to affect sediment transport.

40.5.202 Sediments can cause damage to aquatic invertebrates and fish through deposition resulting in a smothering effect, reducing microhabitat availability or by interference with feeding and respiratory apparatus. Salmonids have a suspended solids tolerance of around 30mg/L (see Freshwater Survey report in Appendix A40.9 for more details). Alabaster and Lloyd (1982) summarise that long-term levels of suspended sediment below 25mg/L^{-1} would have no harmful effects on fish. 25-80mg/L^{-1} levels are acceptable as a rule of thumb, 80-400mg/L^{-1} are unlikely to support good fisheries and levels over 400mg/L^{-1} generally will not support substantial fish populations.

40.5.203 During road construction, suspended solids reaching the water column would be likely to originate principally from sediment laden runoff. For example, topsoil would be stripped to prepare the ground for road construction, leaving the earth bare. During a rain event, water falling on this surface would pick up loose sediment on its way to the receiving watercourses. Where it is possible to assess these impacts quantitatively, this has been completed using sediment modelling

(please refer to Appendix A39.5, Annex 27). Otherwise, potential impacts on receiving watercourses have been assessed qualitatively and are addressed in Chapter 39 (Water Environment) and Appendix A39.2 (Fluvial Geomorphology).

40.5.204 Suspended solids may also contain contaminants, which can cause pollution of the receiving watercourse. Sediment smothering can also reduce light availability for aquatic plants, which can lead to die back and in turn increase organic loading and its associated impacts including lowered levels of dissolved oxygen (see above). Increased turbidity can hamper predatory macroinvertebrates' search for prey. Additionally, increased turbidity as sediment is entrained in the water column can lead to decreased dissolved oxygen (DO) levels.

40.5.205 During operation, increased sediment loading could result from road runoff, particularly during and following heavy rain when road drainage systems may not function optimally. In addition, the proposed scheme may result in a substantial change to the discharge regime (see below) and this could permanently alter the sediment transport and geomorphological character of some of the watercourses (see Fluvial Geomorphology, Appendix A39.2). This could indirectly impact on aquatic organisms specifically adapted to microhabitats, which may be lost through changes in sediment dynamics. For example increased scour may adversely affect a caddis fly species which relies on fine sand to build its case or an area may become unsuitable for salmon egg laying.

Decrease in Stream and Bank Side Habitat Complexity

40.5.206 Construction of the proposed scheme would involve numerous watercourse crossings and at each of these crossing points there is likely to be a degree of habitat simplification/modification. This can occur through culverting, channel straightening, bank reinforcement or reprofiling, river diversion, over deepening, or clearing of the riparian zone. All of these activities have the potential to reduce habitat and food availability for aquatic species, in turn leading to decreases in species richness and mortality.

40.5.207 In particular, the use of culverts with smooth substrates, rather than those that allow the natural river bed to remain, substantially reduce stream habitat complexity and thus niche availability for macroinvertebrates. As the road would probably be at least 30m wide (wider in the embanked sections), the length of each watercourse to be crossed by culverts is likely to be straightened and the riparian habitat lost would result in reduced channel sinuosity and decreased flow heterogeneity. River diversions would also result in reaches being straightened and riparian habitat loss. More seriously however, some river diversions may substantially reduce the total river length, leading to changes in discharge regime and sediment transport (see below). These may in turn simplify in-stream and marginal habitat characteristics and lead to increased erosion and flooding.

40.5.208 Operation of the proposed scheme would include maintenance of the road and verges. This could potentially impact on riparian zone habitat complexity through bank mowing. The spread of exotic species such as Japanese Knotweed (*Fallopia japonica*) could result in simplification of riparian habitat. In other respects operation is not likely to substantially affect in-stream and bankside habitat complexity, apart from changes to the discharge or sediment transport regimes.

Habitat Fragmentation

40.5.209 Habitat fragmentation in watercourses usually involves some kind of physical barrier, which can stop the free movement of fauna. Culverts under dual carriageway roads typically constitute long straightened reaches of smooth substrate with no in-stream or bankside habitat complexity and associated food resources, and may also result in changes in slope and faster flow conditions. In addition to habitat modification, substantial shading can also be a key impact of long culverts. All of these factors could pose a barrier to fish, otter and invertebrate movement.

40.5.210 In addition to culverts, river diversions can also cause habitat fragmentation by reducing channel sinuosity and potentially changing the discharge regime, which may stop or hamper the movement of fauna which require specific flow conditions to migrate up or down the river system.

40.5.211 Habitat fragmentation is particularly relevant to salmonid fish (i.e. salmon and trout), which need to migrate upstream to breed.

40.5.212 In addition to the impacts described above, operation of the proposed scheme may also result in the culverts becoming blocked if not properly maintained, particularly following periods of heavy rain.

Substantial Changes to Discharge Regime

40.5.213 The proposed construction works would generally alter the slope of the surrounding land and slightly increase the local amount of impermeable surface through the construction of the road pavement. This has the potential to increase the total discharge via runoff to the watercourses, possibly constituting an adverse impact on the aquatic ecosystem. Additionally, temporary and permanent river diversions can also substantially alter the discharge regime through changes in slope and channel sinuosity, affecting water velocities and discharge volumes. Attenuation basins associated with road drainage also have the potential to change the natural discharge regime of watercourses.

40.5.214 Changes to discharge regime can result in substantially changed local habitat and food availability and water quality. Substantial reduction in discharge levels can severely affect flow-reliant species and those sensitive to decreases in dissolved oxygen. Similarly, increased discharge can have adverse impacts on species reliant on slow flow areas such as pools and marginal dead water for feeding and resting (i.e. migratory fish). Increased discharge can also have a microhabitat simplification effect due to scouring and increased flood frequency that can also reduce the number of species able to survive in a variable discharge environment.

40.5.215 Substantial increases or decreases in water velocities of a river can have adverse impacts on the ecosystems it supports. Many species are adapted for specific ranges of water velocities for feeding, breeding, and migratory cues. Also, changes in discharge regime can substantially alter the benthic microhabitat available and cause substantial changes in water quality parameters, particularly dissolved oxygen and biochemical oxygen demand.

40.5.216 Operation of the road is not predicted to substantially affect the discharge regime of local watercourses.

Direct Mortality

40.5.217 The installation of culverts at proposed road crossing points would require the mechanical excavation of the channel bed and the temporary dewatering of a section of the watercourse. This would result in local mortalities if the fish were not moved beforehand, which would be an impact at a local level and on the population as a whole (although to be lesser degree) during construction and operation. Adverse impacts on salmon or sea trout could constitute an offence under the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003.

40.5.218 Fish eggs cannot easily be moved and could be lost from the dewatered reaches, which would result in an impact locally. This could also constitute an offence under the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003.

40.5.219 It is possible that noise and vibration from construction works during the sensitive stages of salmonid egg incubation could result in damage to eggs close to the source of the vibration. This would have an impact at a local level with the potential for population impacts if works are not staged. This could also constitute an offence under the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003.

Disturbance

40.5.220 Fish are sensitive to a number of disturbances including sound pressure, vibration and light, with the degree of sensitivity varying between species and life stage. The potential for disturbance to

some species and life stages during the construction phase is high. Resident fish, some of which are territorial, are likely to leave the area adjacent to the works and will need to find new territories, resulting in increased competition elsewhere. This disturbance would likely result in a local impact on resident fish within the affected area.

Specific Impacts

40.5.221 The following is a summary of the potential impacts identified for the freshwater environment in Section FL1 to FL3.

Section FL1

40.5.222 In order to install a culvert on Megray Burn, realignment of the channel would be required. The associated construction works would involve earthworks, resulting in sediment and/or other pollution release. This would result in localised impacts on habitat complexity within the length of culvert, which may also lead to localised changes in species distribution. The realigned channel would be slow to recover the existing 'good' quality and with different substrate, shading and gradient, the aquatic invertebrate assemblage may never return to current conditions. These impacts are assessed as having medium negative magnitude and Moderate significance

40.5.223 Limpet Burn is an important wildlife corridor. Realignment of the burn for the buried structure has been minimised and the structure has been designed to be as open as possible in order to reduce potential impacts on the connectivity of habitat. Some physical damage to the complex wetland habitat around the burn would result from construction of the crossing. The buried structure is likely to permenantly alter the hydrological regime of the burn and its wetlands by constricting its width. It would shade the area of the burn and wetland underneath such that the plants that currently proliferate in the valley would be unlikely to persist. These impacts are therefore considered to be of medium negative magnitude and Moderate significance.

40.5.224 Potential impacts on Green Burn would be occur as a result of the installation of two culverts and associated realignments. The construction works involved would require earthworks, resulting in sediment and/or other pollution release. During the operational scheme, the culverts would result in loss and fragmentation of habitat. In addition, the burn would receive road runoff from the road drainage system. These impacts are predicted to be of medium negative Magnitude and Moderate significance.

Section FL2

40.5.225 No impacts of Moderate or greater significance are predicted in this section.

Section FL3

40.5.226 No impacts of Moderate or greater significance are predicted in this section.

Wintering Birds

Direct Mortality

40.5.227 Many bird species will attempt to cross active roads to move between habitat fragments (Salter, 1994). RTAs typically occur where woodland or scrub habitats are located immediately adjacent to busy roads and it likely that low flying bird species (e.g. members of the thrush family, owls and game birds) would be the greatest affected.

40.5.228 High mortality rates associated with operational roads reduces the exchange of bird populations between habitats and thus increases isolation effects, demonstrating the link between mortality and barrier effects caused by fragmentation (Van Apeldoorn,1995).

40.5.229 An increase in direct mortality resulting from habitat fragmentation associated with an increase in number of roads and road traffic within the UK, has been highlighted as a major component in the decline of some bird species such as the barn owl (a WCA Schedule 1 species).

Habitat Loss

40.5.230 The direct impact of the proposed scheme would be the physical loss of breeding and foraging habitats along the route corridor. The impacts associated with direct habitat loss would be increased by the interaction of disturbance and fragmentation/isolation impacts, which if combined can lead to a change in the distribution of species within a route corridor or wider study area (Iuell et al., 2003).

40.5.231 Habitat clearance would also result in the direct loss of foraging habitat through the loss of plant food groups such as buds or berries and the indirect loss of invertebrate communities. These form a major dietary constituent for the majority of small to medium sized bird species (e.g. blue tit or song thrush).

40.5.232 Species are likely to be most adversely impacted by habitat loss are barn owl, bullfinch, crossbill, fieldfare, greylag goose, linnet, mistle thrush, pink-footed goose, redwing, reed bunting, skylark, snipe, song thrush, tree sparrow, twite and yellowhammer associated with the loss of woodland, wetland and agricultural habitats. The loss of agricultural land is a particularly important impact upon pink-footed and greylag geese that rely on such areas for over wintering feeding.

Habitat Fragmentation and Isolation

40.5.233 Bird species diversity and local species extinctions have been found to be more pronounced in smaller woods than in larger areas of woodland (Hinsley et al., 1992 in English Nature, 2001).

40.5.234 Fragmentation and isolation would have an adverse impact on local bird populations through a reduction in dispersal and subsequent isolation of species, which could potentially result in a reduction in population sizes. The extent of these impacts would be dependent on the size of the isolated area of habitat and the species affected, as the ability to avoid genetic isolation and localised extinctions by moving between fragmented habitats varies between bird species.

40.5.235 Operation of the proposed scheme would result in fragmentation and isolation impacts on bird populations. This would occur through a restriction in dispersal and movement of species between habitats (fragmented by construction) resulting from direct mortality, habitat loss associated with minimal operational maintenance, and noise and vibration disturbance caused by road traffic. The continued fragmentation and isolation of bird species within severed habitats could have a detrimental effect on species population dynamics and ultimately population viability.

Disturbance

40.5.236 Disturbance resulting from noise and vibration associated with construction of the proposed scheme would occur in two stages. The first stage would result from pre-construction habitat clearance. The second stage would result from both direct disturbance (e.g. from earthmoving machinery) and indirect disturbance (e.g. human activity). Both direct and indirect disturbance would contribute to an increase in the effects of fragmentation and isolation.

40.5.237 Road lighting can have adverse impacts on bird species and can affect both breeding and foraging behaviour in a number of species of birds. This was first observed by Rawson (1932), who demonstrated the correlation between critical light levels at dawn and singing in thrushes, suggesting that artificial lighting could modify the timing of natural behavioural patterns. Impacts from light pollution have also been observed in nocturnal bird such as barn owl (Hill, 1992).

Pollution and Other Indirect Impacts

40.5.238 Ballard and Hacker (1996) have shown that de-icing salt used in the winter to keep roads ice-free can potentially result in the death of seed eating birds such as finches, which consume seeds contaminated by salt. The application of de-icing salt to during winter and the indirect pollution of adjacent habitats via vehicle spray could potentially result in the death of seed eating bird species. These species are likely to forage in habitats adjacent to the wide verges of the scheme with varied nut or berry bearing planting being most likely to be most impacted.

Specific Impacts

Section FL1

40.5.239 Potential impacts on wintering birds during construction and operation are predicted to be of Moderate impact significance in Habitat Area F12 due to the potential for pollution of Green Burn, direct mortality through RTA, fragmentation and isolation, disturbance and habitat loss.

Section FL2

40.5.240 Potential impacts on wintering birds during construction and operation are predicted to be of Moderate impact significance in Habitat Areas F13, F15 and F16 due to the potential for pollution of the field ditches that form Allochie Burn, the Burn of Muchalls and the Burn of Blackbutts. Impacts would also occur as a result of direct mortality through RTA, fragmentation and isolation, disturbance and habitat loss.

Section FL3

40.5.241 Potential impacts on wintering birds during construction and operation are predicted to be of Moderate impact significance in Habitat Areas F21, F22, F23 and F26 due to the risk potential pollution of Whiteside Burn, Cairns Burn, Crossley Burn, Circle Burn, Craigentath Burn and Wedderhill Burn. Impacts would also occur as a result of direct mortality through RTA, fragmentation/isolation, disturbance and habitat loss.

Summary of Potential Impacts

40.5.242 In-line with the summary of impacts for other species groups, the following summary of impacts for bats and breeding birds only considers impacts with significance equal to or greater than moderate.

Section FL1

40.5.243 Potential impacts of Major significance would occur on the terrestrial habitat of Limpet Burn and Fishermyre. Impacts of Moderate significance are likely to affect badger due to the presence of an outlier sett above Limpet Burn, where the impacts of habitat loss to freshwater habitat is also likely to be of Moderate significance. Potential impacts of Moderate significance are predicted to occur for bats due to the risk of direct mortality, fragmentation, severance of commuting routes, pollution from runoff and disturbance from night works at Megray Burn, Megray Wood, Limpet Burn and New Mains of Ury. Potential impacts of Moderate significance are predicted to occur for breeding birds to pollution due to accidental spills during construction and fragmentation/isolation, disturbance, habitat loss and pollution due to runoff during operation of the scheme at North and South Fishmyre. Potential impacts of Moderate significance are predicted at Megray Burn and Green Burn and Major significance at Limpet Burn for otter during construction and potential impacts of Major significance to water voles at numerous waterbodies within FL1. Potential impacts of Moderate significance are predicted for water shrews in Megray Burn, Limpet Burn and Green Burn. Potential impacts of Moderate significance are predicted for wintering birds in HA F12 during both construction and operation, due to the risk of pollution of Green Burn, direct mortality through RTA, habitat fragmentation and isolation, disturbance and habitat loss.

Section FL2

40.5.244 Potential impacts of Major significance are predicted for the terrestrial habitat of the Burn of Muchalls. There would be impacts of Moderate significance to several badger groups throughout FL2 due primarily to territory severance. Potential impacts of Major and Moderate significance are predicted to occur for bats due to direct mortality and disturbance during construction and direct mortality, loss of habitat, fragmentation and pollution during operation at Burn of Muchalls, Woodview and Elrick Farm, Burn of Blackbutts and Burnside. Potential impacts of Moderate significance are predicted to occur for breeding birds due to potential pollution during construction and risk of direct mortality, fragmentation/isolation, disturbance, habitat loss and pollution during the operation of the scheme at Burn of Muchalls and the area surrounding Cookney. Impacts of Moderate/Major significance on otters are anticipated at Back Burn due to disturbance and severance respectively, and Major significance at the Burn of Muchals due to direct mortality, severance and disturbance during construction. During operation, there would be impacts of Major significance for otter at the Burn of Muchalls due to habitat loss, disturbance and potential pollution while impacts of Moderate significance are anticipated at Back Burn due to disturbance. There would be potential impacts of Major significance to water voles at numerous waterbodies within FL2 primarily through habitat loss and severance. Potential impacts of Moderate significance are predicted for wintering birds during construction and operation in Habitat Areas F13, F15 and F16. This is due to potential pollution of the field ditches that form Allochie Burn, the Burn of Muchalls and the Burn of Blackbutts, habitat fragmentation and isolation, disturbance, habitat loss and the increased risk of direct mortality through RTA.

Section FL3

40.5.245 The terrestrial habitat and badger population in Section FL3 would experience impacts of Moderate significance. Potential impacts of Major significance are expected for bats due to the risk of direct mortality at North Cookney Croft and North Rothnick Farm during the operation. Potential impacts of Moderate significance for breeding birds due to risk of potential pollution at Harecraig and Strannog are predicted during the construction and operation of the scheme. There would be impacts of Moderate significance on otters at Balnagubs and Crossley Burns. Impacts of Major significance at the Burn of Elsick are predicted due to the construction and operation of new culverts and associated habitat loss and fragmentation. Potential impacts on wintering birds during construction and operation are predicted to be of Moderate impact significance in Habitat Areas F21, F22, F23 and F26 due to the risk potential pollution of Whiteside Burn, Cairns Burn, Crossley Burn, Circle Burn, Craigentath Burn and Wedderhill Burn. Impacts would also occur due to habitat fragmentation, disturbance, habitat loss and the increased risk of direct mortality through RTAs.

Table 40.20 – Potential Construction Impacts (of Moderate or Above)

Ecological Receptor	Area	Habitat Area	Evaluation	Impact	Magnitude	Impact Significance
Section FL 1						
Terrestrial Habitats	Limpet Burn	F7	Regional	Severance and fragmentation of habitats on either side of route during construction. Furthermore, potential pollution and disturbance to remaining habitats may occur.	high negative	Major
	Fishermyre Wood South and Fishermyre Wood wet habitats to the south of Allochie Croft	F10, F12	Regional	Severance and fragmentation of habitats on either side of route during construction. Furthermore, potential pollution, hydrological impacts and disturbance to remaining habitats may occur.	high negative	Major
Badger	Limpet Burn Social Group B	F6, F7	County	Scheme would result in the loss of main sett B1 and outlier sett B2, leading to possible injury or fatality of badgers in the sett.	high negative	Moderate
Bats	Megray Wood, Limpet Burn, Agricultural fields to the north of Megray Farm, Fishermyre Wood South.	F6, F7, F8, F10	County	Risk of direct mortality where the proposed carriageway passes through Megray Wood and through woodland adjacent to Megray Burn and Fishermyre.	Hhign negative	Moderate
	Agricultural fields between the A90 and Stonehaven, Limpet Burn.	F3, F7	Regional	Fragmentation and severance to commuting routes at Megray Burn and the farm access track and at Limpet Burn.	Medium negative	Moderate
	Agricultural fields between the A90 and Stonehaven.	F2	County	Possible disturbance to bats roosting at New Mains of Ury.	Medium negative	Moderate
	Megray Wood and Limpet Burn	F6, F7	County	Disturbance to foraging and commuting bats in Megray Wood and Limpet Burn.	Medium negative	Moderate
Breeding Birds	North and South Fishmyre	F10, F12	County	Habitat fragmentation/isolation, disturbance and pollution due to accidental spills.	Medium negative	Moderate
Otter	Megray Burn and Green Burn	F3, F4, F7, F8	County	Risk of direct mortality and disturbance during construction	High negative	Moderate
	Limpet Burn	F6, F7	Regional	Risk of direct mortality and disturbance during construction	High negative	Major
				Construction of the scheme would cause severance of Limpet Burn along a commuting route between the sea and upstream resources including Megray Burn, Fishermyre Moss and Fishermyre Pond	High negative	Major

Ecological Receptor	Area	Habitat Area	Evaluation	Impact	Magnitude	Impact Significance
Water Vole	Green Burn, Fishermyre Moss Drain and Fishermyre Moss	F8, F10, F12	National	Risk of direct mortality during habitat clearance for construction	High negative	Major
Freshwater	Megray Burn	F3, F4	County	Risk of sediment and/or other pollution release into the burn during construction of proposed culvert.	Medium negative	Moderate
	Limpet Burn	F7	Regional	The creation of the buried structure would involve some earthworks, resulting in sediment and/or other pollution release. Some physical damage to the complex wetland habitat around the burn may also result from construction	Medium negative	Moderate
	Green Burn	F8, F10	County	Culvert construction and burn realignment would involve some earthworks, resulting in sediment and/or other pollution release into the burn.	Medium negative	Moderate
Wintering Birds	Fishermyre	F10, F12	County	Habitat fragmentation and isolation, disturbance and potential pollution of Green Burn due to accidental spills during construction.	Medium negative	Moderate
Section FL 2						
Terrestrial Habitats	Burn of Muchalls	F15	Regional	Severance and fragmentation of habitats on either side of route during construction. Furthermore, potential pollution and disturbance to remaining habitats may occur.	High negative	Major
Bats	Burn of Muchalls	F15	Regional	Risk of direct mortality due to felling of trees with roost potential.	High negative	Major
	Agricultural fields surrounding Hill of Muchals	F13, F16	Regional	Disturbance during construction to roosts located within 200m of proposed scheme and site compounds.	Medium negative	Moderate
Breeding Birds	Burn of Muchalls and area surrounding Cookney	F15, F16	County	Potential pollution due to accidental spills.	Medium negative	Moderate
Otter	Back Burn	F13	Regional	Scheme passes within 50m of potential couch C3. Disturbance possible if otters are lying up along the burn.	Medium negative	Moderate
	Burn of Muchalls	F15	National	Risk of direct mortality or disturbance from construction activities. Additional disturbance possible at potential couch C4	High negative	Major
				Construction of scheme would cause severance of the Burn of Muchalls along a commuting route between the sea and upstream resources including Back Burn, Red Moss of Netherley, ponds and habitats further along the burn.	High negative	Major
Wintering Birds	Hill of Muchalls	F13	County	Potential pollution of field ditches which form the Allochie Burn due to accidental spills	Medium negative	Moderate
	Burnside	F15	County	Potential pollution of the Burn of Muchalls due to accidental spills	Medium negative	Moderate
	Cookney	F16	County	Potential pollution of the Burn of Blackbutts due to accidental spills.	Medium negative	Moderate
Section FL 3						
Terrestrial Habitats	Stoneyhill	F19	County	Potential hydrological impacts on wetland habitats during construction. Also potential pollution and disturbance impacts may occur.	Medium negative	Moderate

Ecological Receptor	Area	Habitat Area	Evaluation	Impact	Magnitude	Impact Significance
	Wet habitats around East Crossley	F21	County	Severance and fragmentation of habitats on either side of route during construction. Furthermore, potential hydrological impacts on wetland habitats, potential pollution and disturbance impacts may occur.	High negative	Moderate
	Dry heath/acid grassland mosaic to the west of Wedderhill	F23	County	Severance and fragmentation of habitats on either side of route during construction. Furthermore, potential hydrological impacts on adjoining wetland habitats (F24) may occur.	Medium negative	Moderate
	Bog/heath to the immediate west of Wedderhill	F24	County	Severance of hydrological connectivity during construction of the scheme could result in drying out of wetland habitat.	High negative	Moderate
Breeding Birds	North of Burn of Muchalls to Cookney, Grassland west of Wedderhill, Woodland South of Stannog	F18, F19, F23, F25	County	Potential pollution due to accidental spills at Harecraig and Strannog Hill.	Medium negative	Moderate
Otter	Balnagubs Burn	F18	County	Scheme crosses the burn which is likely to be used regularly by otters for foraging and lying up. Otters may therefore suffer direct mortality and disturbance during construction activities	High negative	Moderate
	Burn of Elsick	F18	Regional	Proposed scheme crosses the burn which is likely to be an important otter foraging and commuting resource. Otters may therefore suffer direct mortality and disturbance during construction activities	High negative	Major
Wintering Birds	Crossley	F21	County	Potential pollution of Whiteside Burn due to accidental spills.	Medium negative	Moderate
	East Crossley	F22	County	Potential pollution of Cairns Burn and Crossley Burn due to accidental spills.	Medium negative	Moderate
	East of Stranog Hill	F23	County	Potential pollution of Circle Burn due to accidental spills.	Medium negative	Moderate
	Crynoch/Craigentath Burns	F26	County	Potential pollution of Craigentath Burn and Ditch, Wedderhill Burn and Burnhead Burn due to accidental spills.	Medium negative	Moderate

Table 40.21 – Potential Operational Impacts (of Moderate or Above)

Ecological Receptor	Area	Habitat Area	Evaluation	Impact	Magnitude	Impact Significance
Section FL 1						
Terrestrial Habitats	Limpet Burn	F7	Regional	Direct habitat loss of UK BAP and other habitats where the proposed route crosses. Severance and fragmentation of habitats is also predicted on either side of route due to the operational scheme. Furthermore, potential pollution and disturbance to remaining habitats may occur.	High negative	Major
	Fishermyre Wood South and Fishermyre Wood wet habitats to the south of Allochie Croft	F10, F12	Regional	Direct habitat loss of UK BAP habitats of wet woodland and fen and other habitats where the proposed route crosses. Severance and fragmentation of habitats on either side of route due to the operational scheme is also predicted. Furthermore, potential pollution, hydrological impacts to wetland and disturbance to remaining habitats may occur.	High negative	Major
Badger	Limpet Burn Social Group B	F6, F7	County	Increased risk of RTAs, particularly where the proposed scheme crosses actual and probable badger paths at ch1100, ch1150, ch1300, ch1500 and ch1775.	High negative	Moderate
				The loss of main sett B1 would result in a series of impacts on the social group including: displacement from their home range and main sett, and increased territorial conflict with neighbouring social groups (Groups A and C). It is unlikely that the social group would continue to exist.	High negative	Moderate
				Severance of approximately 50% of badger group's territory, including potential foraging habitat. Furthermore, outlier setts B3, B4 and B6 would be cut-off from the main sett. This is likely to lead to increased territorial conflict with neighbouring social groups (Group C).	High negative	Moderate
Bats	Megray Burn and Limpet Burn	F7, F8	County	Potential risk of direct mortality due to severance of known commuting routes along Megray Burn, a farm access track, Limpet Burn and two minor roads.	Medium negative	Moderate
				Loss of high value foraging and roosting habitat adjacent to Limpet Burn and in Megray Wood.		
	Limpet Burn	F8	County	Risk of potential pollution reducing suitability of Limpet Ponds as foraging habitats.	Medium negative	Moderate
Breeding Birds	North and South Fishmyre	F10, F12	County	Potential risk of direct mortality, fragmentation/isolation, disturbance, habitat loss and pollution due to run off.	Medium negative	Moderate
Otter	Megray Burn	F3, F4	County	Burn to be extensively realigned with associated long term loss of foraging and lying up habitat including H-Ram Wood, pond and riffle/pool structure of the burn	Medium negative	Moderate
				Increased disturbance due to operation of the road, including due to junction lighting at the A90 may lead to burn becoming unsuitable for foraging	Medium negative	Moderate
				Risk of deterioration in water quality due to runoff from the scheme	Medium negative	Moderate
				Increased risk of direct mortality through RTAs where the scheme crosses Megray Burn	High negative	Moderate
	Limpet Burn	F6, F7	Regional	Increased risk of direct mortality through RTAs and/or drowning where proposed scheme crosses burn.	High negative	Major

Ecological Receptor	Area	Habitat Area	Evaluation	Impact	Magnitude	Impact Significance
				Loss of high value riparian woodland habitat at the edge of Megray Wood and in the valley due to burn realignment increased disturbance in Megray Wood which is likely to be used by otters for lying-up.	Medium negative	Moderate
				The length of the bridge may impact on water quality due to lack of light and fish populations may be affected by oxygen sag. There may also be pollution impacts due to particulates downstream, including ponds and associated foraging habitat.	High negative	Major
	Green Burn	F8	County	Increased risk of direct mortality through RTAs during the operational scheme	High negative	Moderate
				Some loss of medium value habitat comprising moorland and scrub at edge of Fishermyre Moss and associated secluded lying-up habitat	Medium negative	Moderate
				Scheme would sever of commuting route between Green Burn and lying up habitat and resources including Fishermyre Moss and Pond, and Coneyhatch Burn to the west of the scheme	High negative	Moderate
				Disturbance likely if otters are breeding or lying-up in Fishermyre Moss	High negative	Moderate
				Risk or deterioration in water quality due to runoff from the operational scheme.	High negative	Moderate
Water Vole	Green Burn	F8	National	Loss of approximately 4.5ha of water vole habitat due to landtake of the scheme. A further potential loss of 4.75ha of water vole habitat may occur if local hydrology is disrupted.	High negative	Major
				Severance of the water vole colony and habitat at Green Burn from the rest of the water vole metapopulation and habitat. Road would also serve as a barrier to potential future colonization of waterbodies 1-4.	High negative	Major
	Fishermyre Moss Drain	F10	National	Increased risk of direct mortality if the culvert proposed at ch3125 is inappropriately designed.	High negative	Major
				Loss of 140m length of water vole inhabited ditch.	High negative	Major
				Severance and fragmentation of the water vole meta-population and habitat.	High negative	Major
	Fishermyre Moss	F12	National	Loss of 4.2ha of water vole habitat due to landtake of the proposed road. A further potential loss of 35ha water vole habitat may occur if the local hydrology is disrupted.	High negative	Major
				Severance and fragmentation of the water vole meta-population and habitat.	High negative	Major
Freshwater	Megray Burn	F3, F4	County	Burn realignment is predicted to result in substantial habitat loss. There would be a localised impact upon habitat complexity within the length of culvert	Medium negative	Moderate
	Limpet Burn	F7	Regional	The buried structure is likely to permanently alter the hydrological regime of the burn and its wetlands	Medium negative	Moderate
	Green Burn	F8, F10	County	Proposed culverts would likely result in loss and fragmentation of habitat. In addition, treated road runoff would be discharged to a swale and then into the burn.	Medium negative	Moderate
Wintering Birds	Fishermyre	F10, F12	County	Risk of direct mortality through RTA, habitat fragmentation and isolation, disturbance, loss of dry heath, acid grassland and marsh/marshy grassland habitat and potential pollution of Green Burn due to runoff.	Medium negative	Moderate

Ecological Receptor	Area	Habitat Area	Evaluation	Impact	Magnitude	Impact Significance
Section FL 2						
Terrestrial Habitats	Burn of Muchalls	F15	Regional	Severance and fragmentation of habitats on either side of route due to the operational scheme is also predicted. Furthermore, potential pollution and disturbance to remaining habitats may occur.	High negative	Major
				Direct loss of stream habitat	Medium negative	Moderate
Badger	Clayfolds Social Group D	F16	County	Increased risk of RTAs, particularly where the proposed scheme crosses probable badger paths at ch4700 and ch5600.	High negative	Moderate
				Severance of approximately 30% of badger group's territory, including potential foraging habitat. Furthermore, outlier setts D2 and D3 would be cut-off from the main sett. This is likely to lead to increased territorial conflict with neighbouring social groups.	Medium negative	Moderate
Bats	Agricultural fields surrounding Hill of Muchals, Burn of Muchalls, Cookney	F13, F15, F16	Regional	Direct mortality along farm track south of Burnside, the Burn of Muchalls and the Burn of Blackbutts due to the severance of commuting routes.	High negaitve	Major
	Fishmyre	F15	Regional	Reduced habitat suitablility for foraging and commuting due to habitat loss at the Burn of Mucalls and severance of Fishmyre.	Medium negative	Moderate
Breeding Birds	Burn of Muchalls, Cookney	F15, F16	County	Potential risk of direct mortality, fragmentation/isolation, disturbance, habitat loss and pollution due to run off for the Burn of Muchalls and the areas surrounding Cookney.	Medium negative	Moderate
Otter	Back Burn	F13	Regional	Scheme passes within 50m of burn. Disturbance possible due to operation of road	Medium negative	Moderate
	Burn of Muchalls	F15	National	Loss of high value habitat comprising riparian woodland and associated foraging and potential lying up habitat adjacent to Burnside Farm.	Medium negative	Major
				Scheme would increase disturbance to otters if lying up along burn and may reduce the suitability of the burn for otters	Medium negative	Major
				The length of the bridge may impact on water quality due to lack of light and fish populations may be affected by oxygen sag. There may also be pollution due to particulates downstream.	High negative	Major
Wintering Birds	Hill of Muchalls	F13	County	Potential pollution of field ditches which form the Allochie Burn due to runoff.	Medium negative	Moderate
	Burnside	F15	County	Potential pollution of the Burn of Muchalls due to runoff.	Medium negative	Moderate
	Cookney	F16	County	Direct mortality through RTA, fragmentation and isolation, disturbance and loss of arable and improved grassland. Potential pollution of the Burn of Blackbutts due to runoff.	Medium negative	Moderate
Section FL 3						
Terrestrial Habitats	Stoneyhill	F19	County	Loss of marshy grassland and developing UK BAP habitat Also, potential hydrological impacts on wetland habitats, potential pollution and disturbance impacts may occur during the operational scheme.	Medium negative	Moderate

Ecological Receptor	Area	Habitat Area	Evaluation	Impact	Magnitude	Impact Significance
	Wet habitats around East Crossley	F21	County	Direct loss of acid grassland, dry heath and marshy grassland is predicted. Severance and fragmentation of habitats on either side of route during the operational scheme is predicted. In addition, potential hydrological impacts on wetland habitats, potential pollution and disturbance impacts may occur.	High negative	Moderate
	Dry heath/acid grassland mosaic to the west of Wedderhill	F23	County	Direct loss of acid grassland and dry heath habitat is predicted. Severance and fragmentation of habitats on either side of route during the operational scheme is also predicted. Furthermore, potential hydrological impacts on adjoining wetland habitats (F24) may occur.	Medium negative	Moderate
	Bog/heath to the immediate west of Wedderhill	F24	County	Severance of hydrological connectivity during the operational scheme could result in drying out of wetland habitat.	High negative	Moderate
Badger	West Stoneyhill Social Group E	Outside study area	County	Increased risk of RTAs, particularly where the proposed scheme crosses actual and probable badger paths at ch6825 and ch7250.	High negative	Moderate
				Severance of approximately 20% of badger group's territory, including potential foraging habitat. This is likely to lead to increased territorial conflict with neighbouring social groups.	High negative	Moderate
	Stranog Hill Social Group F	F22, F23	County	Increased risk of RTAs, particularly where the proposed scheme crosses actual and probable badger paths at ch9600, ch9725, ch10075 and ch10400.	High negative	Moderate
				Severance of approximately 20% of badger group's territory, including potential foraging habitat.	Medium negative	Moderate
	Craigentath Social Group G	Outside study area	County	Increased risk of RTAs, particularly where the proposed scheme crosses badger paths.	High negative	Moderate
				Severance of approximately 15% of badger group's territory, including potential foraging habitat. This is likely to lead to increased territorial conflict with neighbouring social groups (groups F and I).	Medium negative	Moderate
Bats	North Cookney Croft	F18	Regional	Risk of direct mortality where the carriageway passes close to a pipistrelle roost at North Cookney Croft and track adjacent to North Rothnick Farm.	High negative	Major
Breeding Birds	North Cookney Croft, Stoneyhill, Grassland and bog. heath west of Wedderhill,	F18, F19, F23, F24	County	Risk of potential pollution due to run off.	Medium negaitve	Moderate
Otter	Balnagubs Burn	F16	County	Increased risk of direct mortality through RTAs and/or drowning where scheme crosses burn	High negative	Moderate
				Loss of medium value foraging and potential lying up habitat comprising riparian scrub and pasture.	Medium negative	Moderate
				Scheme would sever otter movements between the sea and Red Moss although other commuting routes exist at Balnagubs Burn and Crossley Burn	Medium negative	Moderate
				Risk of deterioration in water quality due to runoff from operational scheme. Although otters are only likely to use the burn infrequently the burn flows into the Burn of Elsick which flows into the sea, increasing the significance of this impact.	Medium negative	Moderate

Ecological Receptor	Area	Habitat Area	Evaluation	Impact	Magnitude	Impact Significance
	Burn of Elsick	F18	Regional	Increased risk of direct mortality through RTAs and/or drowning where scheme crosses burn	High negative	Major
				Loss of medium value foraging and potential lying up habitat comprising riparian scrub and pasture.	Medium negative	Moderate
				Scheme would sever otter movements between the sea and resources in the west including Red Moss and Crynoch Burn, although other commuting routes exist	Medium negative	Moderate
				Risk of deterioration in water quality due to runoff from the scheme. Otters are likely to use the burn regularly as a foraging resource	Medium negative	Moderate
	Crossley Burn	F22	County	Increased risk of direct mortality through RTAs where scheme crosses burn.	High negative	Moderate
				Scheme would sever otter movements between the Burn of Elsick and Crossley Quarry Pond/Crynoch Burn along a probable commuting route, although alternative commuting routes exist.	Medium negative	Moderate
Wintering Birds	Crossley	F21	County	Increased risk of direct mortality through RTA, habitat fragmentation and isolation, disturbance and loss of acid grassland and scattered scrub habitat. Potential pollution of the Whiteside Burn due to runoff may also occur.	Medium negaitve	Moderate
	East Crossley	F22	County	Potential pollution of the Cairns Burn and Crossley Burn due to runoff.	Medium negative	Moderate
	East of Stranog	F23	County	Risk of direct mortality through RTA, habitat fragmentation and isolation, disturbance, loss of acid grassland and scattered/dense scrub habitat. Potential pollution of the Circle Burn due to runoff from the operational scheme may also occur.	Medium negative	Moderate
	Crynoth/Craigentath	F26	County	Risk of direct mortality through RTA, habitat fragmentation and isolation, disturbance, loss of improved and arable grassland habitat and small areas of semi-improved and marshy grassland habitat. Potential pollution of the Craigentath Burn and Ditch, Wedderhill Burn and Burnhead Burn due to runoff may also occur.	Medium negative	Moderate

40.6 Mitigation

40.6.1 The principles and objectives for ecological mitigation associated with the AWPR have been developed in discussion with SNH, SEPA and other stakeholders including Transport Scotland, Aberdeenshire Council and Aberdeen City Council. These are reported in a Mitigation Vision Statement (Jacobs, 2007). The statement provides a framework to facilitate the development of mitigation measures to address specific impacts. It also outlines proposals for habitat creation outside the study area to offset cumulative habitat loss and fragmentation impacts throughout the proposed scheme.

40.6.2 In general, a hierarchical approach has been adopted for AWPR mitigation measures, which includes the following:

- to avoid adverse impacts in the first instance, for example by not pursuing a particular option, or by devising alternatives where possible;
- where avoidance is not possible, to reduce the adverse impacts with the aim of eliminating impacts and reducing each impact to being of Minor or Negligible significance;
- where adverse residual impacts remain, measures to offset the adverse impacts at the specific site may be required. For example, habitat creation may be required to offset the local, site-specific impacts associated with habitat loss and fragmentation; and
- where localised site-specific mitigation may not be possible through habitat creation, or where such measures would be ineffective, it may be possible with the agreement of statutory consultees to offset adverse impacts at a a wider, regional level. Such measures may include, for example, habitat creation and/or restoration at sites remote from the point of impact or contributions to strategies that contribute to meeting the targets and objectives of Biodiversity Action Plans (UK or Local BAPs).

40.6.3 Current guidelines highlight the importance of an agreed approach to mitigation with the developer prior to the publication of the ES. For example, the Draft IEEM Guidelines for Ecological Impact Assessment (IEEM, 2006) states that 'An EcIA is effectively meaningless if it provides an assessment of the significance of the residual impacts of a scheme based on the proposed mitigation measures being implemented even though these measures have not been agreed by the developer'. Furthermore, the DMRB (2001, states that 'The aims and objectives of the mitigation and any post construction monitoring should be agreed before the mitigation design process starts'.

40.6.4 The ecological mitigation strategy for the AWPR aims to provide mitigation that reduces the adverse effects of the proposed road, in accordance with UK, Scottish and Local Policies. Articles of legislation relating to the requirements for mitigation are outlined in Chapter 10 (Ecology and Nature Conservation, Part A: Northern Leg), as these are applicable to the entire scheme.

40.6.5 Mitigation includes best practice methods and principles that are applied to the scheme as a whole and site-specific mitigation measures applied to individual locations where appropriate. As summarised in the opening paragraph, prevention or avoidance of these adverse impacts is the primary aim of ecological mitigation. If this is not practical or possible, measures will be proposed to reduce the impact and if this is also not practical or possible then measures to offset the impact are included in the mitigation strategy (IEEM, 2006). Offsetting measures may be addressed at strategic level, as discussed in Part E of the ES.

40.6.6 Mitigation measures such as avoiding sensitive times of year, use of appropriate fencing, adopting best practice procedures for site clearance and ensuring adherence to procedure by the Ecological Clerk of Works (ECoW) will provide efficient safeguards from the potential impacts of the works in most cases. Full details of the generic mitigation required for habitats and individual species are provided in Appendices A40.1 to A40.9. A summary of the generic mitigation measures that apply to all ecological receptors across the scheme is presented Table 40.20.

Table 40.22 – Generic Ecological Mitigation Measures

Effect	Generic Mitigation
Avoid	Comply with the requirements of the Ecological Clerk of Works who will be employed on behalf of the Scottish Executive; Ensure that work compounds and access tracks etc are not located in, or adjacent to, areas that maintain habitat value; Establish site fencing to prevent access to areas outside of working areas, particularly in areas adjacent to features of interest/value; Cover site safety issues including storage of potentially dangerous materials; Pre-construction species surveys of impacted areas, particularly breeding sites to remove animals and therefore prevent direct mortality; Covering of pits or provision of mammal ramps to prevent animals falling in holes and becoming trapped; and Follow SEPA Pollution Prevention Guidelines (PPGS) to prevent the pollution of watercourses through siltation or chemicals.
Reduce	Restrict workforce to working areas through the erection of fencing, to prevent additional damage; Best practice methods will be followed throughout; and Timing of works to minimise disturbance i.e. during the breeding season, night time etc.
Offset	In collaboration with landscape mitigation (see Chapter 41: Landscape), new landscape planting will comprise native species in appropriate locations along verges and on earthwork slopes to create semi-natural habitat such as species-rich grassland, scrub and woodland.

40.6.7 For ecological features where impacts have been assessed as being of Moderate significance or above, where possible, further site-specific mitigation measures are provided in order to minimise impacts on that receptor to a satisfactory level in accordance with policy guidance.

40.6.8 In some cases, the generic and site-specific mitigation that can be applied to address impacts may still result in high residual impacts. It should be emphasised that the four-point scale for assessing impact significance (Negligible, Minor, Moderate and Major) is designed to be used as a guide for interpreting impacts. In practice, the range of impacts is less simplistic, occurring on a gradual scale.

40.6.9 The following outlines the general principles employed during the development of mitigation strategies for impact on habitats and species. All of the mitigation measures described in this chapter have been developed in consultation with the appropriate statutory advisory organisation, i.e. SNH, SEPA and will compliment the Species Management Plans (refer to Section 40.9). It should be noted that although mitigation for roe deer is briefly mentioned in this chapter, this is specifically an animal welfare and road safety issue (refer to A40.8).

40.6.10 Certain mitigation measures such as habitat creation, fencing and underpasses may provide mitigation for numerous receptors simultaneously. For example, badgers and otters will use the same underpasses, while bats will use underpasses, culverts and overbridges if designed and managed sympathetically through the careful control of lighting and planting.

40.6.11 It should be noted that areas of replacement or new planting to mitigate for terrestrial habitat loss will take cognisance of countryside access requirements by pedestrians.

40.6.12 Specific Mitigation

40.6.13 Measures to mitigate the potential impacts of the scheme are described below and, along with selected specific habitat creation, are listed in Table 40.21 for habitats and species. Detailed mitigation for habitats and species, including location requirements and residual impacts is provided in the appendices to this chapter.

40.6.14 Mitigation includes areas where it is assumed land will be aquired through landowner agreement, as well as areas proposed to be bought through Compulsory Purchase Order (CPO). In some cases, the application of mitigation may not reduce impacts sufficiently and a significant residual impact may remain. It is proposed to seek to reduce these impacts through the provision of offset mitigation (refer to Part E of the Environmental Statement). Offset mitigation is in the process of

being developed in consultation and agreement with the regulatory authorities and, thus, in general, location details are unable to be provided at the time of writing this report (see chapter 56).

40.6.15 Information and baseline data previously collected for the scheme have been used to perform a provisional impact assessment for the potential impacts to birds and bats throughout the proposed scheme. Although further data is being collected from surveys during the 2007 survey season, it is expected these data will only re-confirm the current assessment. Mitigation has also been designed from the existing data and baseline information, which will mitigate for the identified impacts to date. Again the ability for this mitigation to provide a protection for these species is anticipated to be further confirmed by the 2007 survey results.

Terrestrial Habitats

40.6.16 Mitigation of ecological impacts on semi-natural habitats has been incorporated into all stages of the scheme design, including route alignment selection and appropriate construction methods. This approach has prevented unnecessary impacts associated with the majority of important ecological habitats and designated sites.

40.6.17 Where the scheme would result in significant impacts on terrestrial habitats that could not be sufficiently mitigated by generic measures, habitat creation will be implemented to offset these impacts.

40.6.18 Along with general ecological mitigation strategies across the proposed scheme, habitat creation will also be aimed at contributing directly to biodiversity targets identified in local (LBAP) and national (UK BAP) strategies. For example, wych elm (LBAP species) will be widely incorporated into roadside planting schemes, wet and riparian woodland (UK and LBAP habitats respectively) will be created along watercourses and localised woodland planting will be designed to improve landscape connectivity for red squirrels (UK and LBAP species).

Badger

40.6.19 Badger underpasses and badger-proof fencing represent the main mitigation techniques in the present scheme for impacts on badgers. Additional mitigation measures that are to be implemented include:

- prevention of direct mortality by sett exclusion. Replacement setts will be created where necessary according to SNH guidelines at least nine months prior to destruction of existing setts. In addition, replacement setts must show evidence of being known to the badgers of the affected social group prior to exclusion. Detailed methodologies for sett exclusion and replacement sett design will be contained in a badger exclusion method statement which will be produced for each affected sett and submitted for SNH for comment and approval;
- provision of underpasses and fencing at strategic locations based upon proximity to existing setts, pathways and areas of high badger activity to prevent RTAs and to reduce habitat fragmentation;
- location of fencing to ensure that badgers have access to areas of new planting for foraging or commuting;
- provision of artificial setts to offset those setts that lie within the footprint of the scheme and will be destroyed; and
- delineation of a 50m buffer around all badger setts (that are not to be excluded and destroyed). No construction activities that constitute ‘disturbance’ to badgers will take place within a 30m buffer zone. Access and connectivity between such sites will also be maintained.

40.6.20 The badger method statement will:

- identify where specific impacts upon badger setts, including loss or disturbance, will occur;
- include the results of further badger surveys;

- describe the status of each sett, taking in to account data recorded during the 2004/2005 surveys and subsequent follow up surveys including sett watching to inform the size of social groups present where appropriate;
- describe in further detail proposed mitigation measures including the location and design of replacement setts where appropriate;
- include details of how the sett exclusion will take place; and
- include details of a monitoring program to ensure that the badger exclusion has been successfully achieved.

40.6.21 A licence can be granted to permit certain actions, which would otherwise be in contravention of the law. For example, disturbance and destruction of a badger sett. The advice of SNH will be sought prior to any such activities and their advice followed. Initially, this advice will be sought in the form of the development of 'ghost licences', which will mirror the contents of the full licence. This approach will enable the development of a method and the full information required to ensure SNH are comfortable that the approach will fulfil the conservation regulations and maintain the favourable conservation status of the species concerned.

Bats

40.6.22 Mitigation for bats is aimed at maintaining populations (particularly breeding populations), minimising disturbance, maintaining access for bats to their present foraging habitats, allowing existing populations to expand and colonise new areas and minimising the risk of road traffic accidents involving bats by:

- prevention of direct mortality by the exclusion of roosts that are to be destroyed. A licence must be obtained from the Scottish Executive Environment and Rural Affairs Department (SEERAD) at least a year in advance of development commencing. It is not necessary to demonstrate that bats are using replacement roosts prior to destruction, however replacement roosts must be provided prior to works;
- ensuring that construction activities, including the felling of trees and destruction of buildings, will be timed to avoid periods when bats are sensitive to disturbance, i.e. summer and winter. Such features will be rigorously inspected immediately prior to their removal by licensed ecologists and a precautionary approach will be adopted to prevent any bat mortalities, e.g. the sectional felling of trees in autumn;
- the use of screens to protect bats which may be roosting in trees during construction
- delineating a 50m buffer around all bat roosts (that are not to be excluded and destroyed). No construction activities that constitute 'disturbance' to bats will take place within a 50m buffer zone;
- ensuring that trees that are to be retained must be safeguarded from damage in accordance with the guidance provided in BS 5837 (1991);
- designing, where appropriate, culverts and underpasses for bats that are at least 1.5m x 1.5m in cross section (Brinkmann et al., 2003). Previous studies have shown that appropriately sized structures will be used by bats (Bach and Limpens, 2004). These structures are also to be included as mitigation for badgers and otters. They will be designed and managed appropriately, for example to allow water to flow through or to include lead-in structures or planting in order to increase bat use and thus reduce fragmentation;
- bat boxes will be erected on buildings, where appropriate, and in agreement with the landowner Similarly, woodland areas lost as part of the scheme will be replaced at nearby suitable locations and existing areas of habitat enhanced;
- linear habitat planting alongside the scheme will be incorporated along bat flyways and within 50m of bat roosts to direct bats over the scheme, therefore preventing direct road mortality from occurring;

- night-time working will not be permitted without agreement from SNH. Carriageway lighting will only be provided where necessary for road safety to minimise impact on bats;
- the use of Sustainable Urban Drainage Systems (SUDS) to manage pollution incidents; and
- areas of riparian woodland will be created alongside burns to offset habitat loss and minimise disturbance through noise reduction. These woodlands will include species of local importance such as wych elm and aspen as well as willow, birch and alder.

40.6.23 A licence can be granted under Section 44 of the Conservation Regulations 1994 that will permit certain actions, which would otherwise be against the law, to be carried out under certain circumstances and where an action is deemed necessary; including where approved development is taking place. Such actions include the killing, injury or taking of bats, or the destruction, damage or obstruction of access to any place used by bats for shelter, protection or breeding including within a dwelling house. The licensing system is provided by SEERAD but the advice of SNH will be sought prior to any such damage and their advice followed.

40.6.24 This advice will be sought in the form of the development of 'ghost licences', which will mirror the contents of the full licence. This approach will enable the development of a method and the full information required to ensure SNH are comfortable that the approach will fulfil the conservation regulations and maintain the favourable conservation status of the species concerned.

40.6.25 Three tests must be granted before a licence may be granted and if any of these tests fail the licence application will be unsuccessful. It must be demonstrated that:

- the reasons for the works must be clearly stated;
- there is no satisfactory alternative to granting a licence; and
- the action proposed will not be detrimental to populations of the species concerned at a favourable conservation status in their natural range.

40.6.26 The conservation status will be taken as 'favourable' when the following criteria are met:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long term basis as a viable component of its natural habitats;
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its population on a long-term basis.

40.6.27 In relation to the requirements as much information as possible will be provided including the following:

- information on the numbers of numbers of animals, habitat type and locations to be affected including details and results of surveys;
- details of the action to be taken and the methodology that will be taken; and
- details of discussions with SNH and any other relevant information.

Breeding Birds

40.6.28 The approach to breeding bird mitigation includes the following key elements:

- construction activities including the felling of trees and clearing of scrub will be timed to avoid periods when birds are nesting (i.e. March-July inclusive), where possible, preventing disturbance to breeding birds. Areas may be pre-felled or cleared in winter to make habitat undesirable for nesting;
- areas of habitat will be created to offset habitat loss, although these areas will be situated away from the scheme to prevent RTAs. This will include the provision of a grassland buffer either

side of the road before any scrub or woodland planting therefore allowing a clear sightline of the traffic;

- planting of dense native tree and scrub species (taking into account direct mortality impacts) to screen noise and vibration disturbance associated with operation of the proposed scheme from birds located within adjacent habitats; and
- sympathetic planting of second (and subsequent) stage detention basins where appropriate to allow use by wintering birds.

Otter

40.6.29 Mitigation for otters is aimed at maintaining populations (particularly breeding populations), minimising disturbance to otters, maintaining access for otters to their present habitats, in order to allow existing otter populations to expand and colonise new areas and to minimise the risk of road traffic accidents involving otters by:

- prevention of direct mortality through the exclusion of holts that are to be destroyed and the provision of artificial holt sites and habitat creation will be necessary. Exclusions will be carried out following prescribed measures and in consultation with SNH. The destruction or disturbance of an otter holt/couch requires a special derogation under the European Habitats Directive. A licence to undertake such works will therefore need to be obtained from SEERAD, which will include a method statement. Advice will be sought from SNH in the form of the development of 'ghost licences', which will mirror the contents of the full licence. This approach will enable the development of a method and the full information required to ensure SNH are comfortable that the approach will fulfil the conservation regulations and maintain the favourable conservation status of the species concerned.
- The licence should be procured at least 10 months prior to development commencing, and a method statement prepared. Detailed methodologies for holt exclusions and artificial holt design will be outlined in this method statement;
- demarcation of areas where otter activity is recorded within 50m of any construction activities during the construction period;
- restricting construction activities within 50m of otter lying-up sites or watercourses to reduce disturbance;
- the incorporation of bridges or culverts (with mammal ledges) on every watercourse crossing to reduce risk of RTAs and reduce habitat fragmentation;
- the erection of otter-proof fencing wherever the scheme comes within 150m of a watercourse or a known otter commuting route to reduce risk of RTAs;
- areas will be marked off to prevent disturbance to the riparian zone (up to 5m from top bank) during the construction period;
- the creation of artificial otter holts where appropriate, management of existing riparian habitat through fencing-off sections of riverbank (to encourage scrub growth), and the provision of ponds, ox-bows and new stream alignments to offset habitat loss and improve carrying capacity;
- night-time working will not be permitted unless agreed by SNH and carriageway lighting will be reduced or eliminated;
- the use of Sustainable Urban Drainage Systems (SUDS) to manage pollution incidents; and
- areas of riparian woodland will be created along side burns to offset habitat loss and minimise disturbance through noise reduction. These woodlands will include species of local importance such as wych elm and aspen as well as willow, birch and alder.

40.6.30 The method statement will also identify;

- where specific impacts upon otters and their habitat will occur;

- the results of further otter surveys including the status of lying-up sites and evidence of breeding:
- mitigation measures including detailed methodologies for holt exclusions and artificial holt design; and
- details of a monitoring programme to ensure that the favourable conservation status of the otter population has not been compromised.

Red Squirrel

40.6.31 Mitigation for red squirrels is aimed at maintaining populations (particularly breeding populations) minimising disturbance; allow existing red squirrel populations to expand and colonise new areas; and to minimising the risk of road traffic accidents involving red squirrels. A strategy to ensure adequate protection of red squirrels and their habitats is being developed in liason with SNH:

- all tree clearance works are to be undertaken from September to November only where practicable, in order to minimise stress to red squirrels during the breeding season;
- pre-construction surveys to confirm presence/absence of active dreys;
- should any active drey be present in the vicinity of the proposed carriageway or other area of proposed works, no action will be taken without prior agreement with SNH;
- new 'core' areas of woodland will be created for red squirrels to offset the loss of existing habitat. Existing woodland will be managed specifically for red squirrels including removing species favourable to grey squirrels such as beech and hazel and planting trees of different age and species composition, e.g. Scots pine, European larch, Norway spruce, birch, ash and alder. This mitigation strategy will also help to prevent red squirrel populations from becoming isolated, as it will connect woodland areas that are currently fragmented by providing commuting corridors; and
- additional mitigation may include the introduction of a scheme in partnership with conservation authorities to manage grey squirrel numbers. This is likely to involve a regime of humane control in pre-identified target areas and will aim to prevent grey squirrels from becoming established in the study area and beyond.

Water Vole

40.6.32 Mitigation for these mammals is aimed at maintaining populations (particularly breeding populations), minimising disturbance and maintaining access to their present habitats in order to allow existing populations to expand and colonise new areas by:

- demarcation of areas where water vole activity is recorded within 50m of any construction activities during the construction period;
- where necessary, undertaking translocations of any populations that may be isolated by the proposed scheme in consultation with SNH. Suitable designs of pond and watercourse network habitats. Locations for their possible locations have been identified and will be finalised following land owner agreement;
- restricting construction activities within 30m of water vole burrow sites or watercourses not to be directly impacted upon to reduce disturbance;
- the incorporation of bridges and box culverts (with mammal ledges) on every watercourse crossing to reduce risk of RTAs and reduce habitat fragmentation;
- minimisation of culvert length to reduce habitat fragmentation;
- marking off areas to prevent disturbance to the riparian zone (to 3m from the bank) during the construction period;
- enhancement of existing riparian habitat through fencing-off sections of riverbank (to encourage scrub growth), and the provision of ponds, ox-bows and new stream alignments to offset habitat loss; and

- the use of Sustainable Urban Drainage Systems (SUDS) to manage pollution incidents.

Water Shrew

40.6.33 A precautionary approach to mitigation has been adopted that reflects the ecological value of habitats. Any loss of suitable habitat will be mitigated for on the assumption that they support a water shrew population and mitigation will be required during construction. Therefore, no specific mitigation is proposed for water shrew. Mitigation prescribed for other species/habitats such as otter, amphibians and freshwater habitat will contribute to mitigating the effects of the scheme on water shrew populations. These include:

- the incorporation of bridges and box culverts (with mammal ledges) on every watercourse crossing to reduce habitat fragmentation;
- marking off areas to prevent disturbance to the riparian zone (to 5m from bank) during the construction period;
- enhancement of existing riparian habitat through fencing-off sections of riverbank (to encourage scrub growth), and the provision of ponds, ox-bows and new stream alignments to offset habitat loss;
- the use of Sustainable Urban Drainage Systems (SUDS) to manage pollution incidents; and
- creation of areas of riparian woodland along side burns to offset habitat loss and minimise disturbance through noise reduction.

Amphibians

40.6.34 Mitigation prescribed for other habitats and species such as otters, badgers and birds include habitat creation will mitigate for the effects of the road scheme on amphibian populations. These include:

- compensatory habitat to offset impacts associated with habitat loss will provide suitable habitats for amphibians, e.g. creation of riparian woodland habitats; and
- underpasses provided for badgers and otters will be suitable for amphibian use thus reducing habitat fragmentation.

Brown Hare

40.6.35 Mitigation prescribed for other species such as badgers and birds, including habitat creation, will also mitigate for the effects of the road scheme on brown hare populations. These include:

- the provision of overpasses, underpasses and fencing as prescribed under mitigation for larger mammals such as badgers, otters and deer to reduce the number of RTAs and reduce fragmentation; and
- compensatory habitat to offset impacts associated with habitat loss will provide suitable habitats for brown hare. This includes creation of grassland, scrub and woodland habitats as prescribed under mitigation for other species such as birds and red squirrel.

Reptiles

40.6.36 No specific mitigation is proposed for reptiles. However, reptiles will benefit indirectly through mitigation for terrestrial and freshwater habitat. The proposed landscaping and planting of the road embankments for other species and for road screening will also be of use to reptiles. Areas that have been identified as being of high potential value to reptiles that would be lost or severed by the road would be made unsuitable for reptile habitation prior to site clearance.

Terrestrial Invertebrates

40.6.37 No specific mitigation is proposed for terrestrial invertebrates, although the mitigation prescribed for terrestrial habitat and other species such as badgers and birds will contribute to mitigating the effects of the scheme on terrestrial invertebrate populations. These include:

- fencing of areas adjacent to construction sites to prevent additional habitat loss on adjacent land; and
- compensatory habitat to offset impacts associated with habitat loss will provide suitable habitat for many terrestrial invertebrate groups.

Freshwater Habitat

40.6.38 The approach to aquatic habitat mitigation includes the following key elements in addition to those safeguards detailed in Chapter 39 (Water Environment):

- road drainage treatment to ensure adherence to strict water quality standards;
- realignments to include meander bends, habitat enhancement and retention of similar channel lengths, where feasible;
- use of culverts that allow the retention of natural substrate and maintenance of similar geomorphological regime; and
- minimisation of culvert length and use of bridges for valuable habitat areas to avoid habitat fragmentation and potential barriers for migratory species.

Fish

40.6.39 The approach to fish mitigation includes the following key elements:

- any activities that require works within salmonid watercourses and/or their dewatering or realignment will be carried out between April and September in order to reduce disturbance to salmonids;
- fish will be removed from sections of waterways to be dewatered, realigned or excavated, using electric fishing and temporarily translocated to an appropriate alternative site;
- disturbance to salmonids through noise and vibration will be reduced through avoiding the first third of the egg incubation period (mid October to end December). A 'soft start' approach will be adopted in the event of any piling (i.e. for Limpet Burn). Where there is high risk of sediment runoff from construction into watercourses, or where in-channel works are required, this should be carried out between May and September; when salmon redds will not be occupied and fry will be sufficiently mobile to move out of construction areas;
- night working will be avoided, allowing a quiet period for migratory fish to pass the construction site. Any lights required for construction sites will be directed away from the water;
- bridges with no in-channel piers (i.e. Burn of Muchalls) will be constructed over salmonid watercourses to prevent damage to salmonid habitat and to prevent disturbance; and
- adherence to SEPA PPGs and the effective use of SUDS, as detailed in Chapter 39 (Water Environment), will prevent/manage pollution incidents during construction and operation.

Wintering Birds

40.6.40 Mitigation for the potential impacts on wintering birds includes the following elements:

- construction activities in the vicinity of key wintering bird habitats will be timed to avoid October to March to prevent disturbance to wintering birds, where possible;
- areas of replacement habitat will be created to offset habitat loss will be situated away from the scheme to prevent RTAs.
- the provision of a grassland buffer either side of the scheme before any scrub or woodland planting therefore allowing birds crossing the road a clear sightline of the traffic;
- planting of dense native tree and scrub species (taking into account direct mortality impacts) to screen noise and vibration disturbance associated with operation of the proposed scheme from birds located within adjacent habitats; and
- sympathetic planting of detention basins, where practicable, to allow use by wintering birds.

Table 40.23 – Selected Specific Mitigation for Habitats and Species.

Impact (Moderate or Greater Significance)	Ecological Receptors	Site Specific Mitigation
Section FL 1		
Direct mortality due to RTAs	Badgers, Otters	Badger and otter-proof fencing to be fitted at ch0-ch4850. In addition, the perimeter of Stonehaven Junction and a 150m stretch of the A90 east and west of the Junction will also be fenced (see Table 12 in A40.2 and Figures 41.5a-d).
Habitat loss of sett	Badgers	Provision of an artificial sett within Limpet Burn Valley at ch1400**,** either east (Potential Relocation Area 1) or west (Potential Relocation Area 2) of the Fastlink. Sett will be designed and constructed in agreement with SNH (see paragraphs 6.2.10 – 6.2.12 in A40.2 and Figure 41.5b).
Habitat Loss	Terrestrial Habitats, Badgers, Bats, Breeding Birds, Otters, Water Vole, Wintering Birds	Planting of mixed and riparian woodland east and west of Fastlink between ch50 – ch600 (E1) along with creation of species rich grassland (see Figure 41.5b). Riparian woodland planting east and west of Fastlink between ch1300 – ch1550 to replace lost vegetation, extend existing vegetation and encourage use of bridge structure by fauna (see Figure 41.5b). Mixed woodland planting at ch1550 (E4) to encourage use of underbridge by mammals (see Figure 41.5c). Creation of a mixed woodland strip to east of Fastlink between ch1550 – ch2200 (see Figure 41.5c). Planting of broadleaved, mixed and scrub woodland east and west of the Fastlink between ch2250 – ch3200 (E6) to encourage use of crossing structures (see Figures 41.5c-d). Riparian woodland planting to be undertaken adjacent to Limpet Burn in such a way as not to attract fauna up the bank to the road; to replace loss of potential otter lying-up habitat (E03). Scattered wet woodland planting at Fishermyre Moss to offset loss of scrub (E05, E07) Creation of pond and watercourse network to provide suitable water vole habitat. Possible locations have been identified and will be finalised following land owner consultation;
Disturbance and fragmentation	Badgers, Bats, Otters	Installation of dry underpasses, depressed invert box culverts and over/under bridges at ch0580, ch1400, ch1550, ch1750, ch2940, ch3125 and ch213 (side road) (details shown in Table 10 in A40.2). Badgers will be encouraged to use crossing structures through appropriate planting (see Figures 41.5a-d and above).
Section FL 2		
Direct mortality due to RTAs	Badgers, Otters	Badger and otter-proof fencing to be fitted at ch4850-ch5750 (see Figures 41.5d-g).
Habitat Loss	Terrestrial Habitats, Badgers, Bats, Breeding Birds, Otters, Wintering Birds	Planting of broadleaved and mixed woodland east and west of Fastlink between ch3250 – ch3475 (see Figure 41.5d). Strip of scrub woodland to be planted east and west of Fastlink between ch3700 – 3900 (see Figure 41.5d). Strip of mixed, scrub and riparian woodland planting east and west of Fastlink between ch4425 – ch5250 (see Figures 41.5ef). Mixed woodland blocks and strips along with scrub woodland to be planted between ch600 – ch6350. Standard trees and mixed woodland will also be planted at ch6350 (E13) to facilitate use of overbridge (see Figure 41.5g).
Disturbance and fragmentation	Badgers, Bats, Otters	Installation of dry underpasses, depressed invert box culverts and over/under bridges at ch3925, ch4625, ch4700, ch5040 and ch5600 (details shown in Table 10 in A40.2). Badgers will be encouraged to use crossing structures through appropriate planting (see Figures 41.5d-g and above).
Section FL 3		
Direct mortality due to RTAs	Badgers, Otters	Badger and otter-proof fencing to be fitted at ch6325 – 7090, ch7400 – 8200, ch8575 – Cleanhill Junction, including the perimeter of the Junction (see Figures 41.5g-k).

Impact (Moderate or Greater Significance)	Ecological Receptors	Site Specific Mitigation
Habitat Loss	Terrestrial Habitats, Badgers ,Bats, Breeding birds, Otters, Wintering Birds	A strip of mixed and scrub woodland to be planted west of Fastlink between ch6500 – ch6950 (see Figure 41.5g). Mixed woodland strip and blocks to be created east and west of Fastlink between ch6950 – ch7250. Strip of scrub woodland to be planted west of Fastlink between ch7550 – ch5975 (see Figure 41.5h). Mixed woodland planting with a high percentage of conifers east and west of Fastlink between ch8250 – ch8550 (see Figure 41.5i). Hedgerow, mixed woodland, scrub and semi-mature trees to be planted at ch8550 (E17) to facilitate use of underbriddge (see Figure 41.5i). Scrub woodland planting west of Fastlink between ch8650 – ch8800 (see Figure 41.5i). Mixed woodland to be created between ch9950 – ch10200 to reduce fragmentation of young woodland (see Figure 41.5j). Mixed woodland and scrub planting east and west of Fastlink between ch11150 – ch11500 (see Figure 41.5k).
Disturbance and fragmentation	Badgers, Bats, Otters	Installation of dry underpasses, depressed invert box culverts and over/under bridges at ch6340, ch6480 (main and side roads), ch6930, ch7550, ch7975, ch8540, ch8850, ch9170, ch10075, ch10210 and ch10630 (details shown in Table 10 in A40.2). Fauna will be encouraged to use crossing structures through appropriate planting (see Figures 41.5g-k and above).

40.7 Recommendations for Further Surveys

Further Surveys due to Limitations

40.7.1 Due to the seasonal constraints and land access issues as detailed in Section 40.2.6, further surveys are required to confirm provisional assessments of impacts on bats and breeding birds.

Bats

40.7.2 Daytime and evening surveys were undertaken in autumn 2006 to establish the status of roosts at different times of the year and to further identify potential hibernacula. As stated earlier, due to access issues daytime surveys and emergence surveys were not completed at a number of buildings within the 500m study area during 2006, therefore these surveys are being completed in 2007. These results will be reported in a subsequent environmental report in 2007.

Breeding Birds

40.7.3 Due to the seasonal constraints and land access issues as detailed in Section 40.2.6, further surveys are underway at the time of writing this report The following SOVs and Quadrats have been re-surveyed for breeding birds from April to June 2007 (refer to Appendix A40.4 Breeding Bird Report):

- Limpet Burn, Kempstone Hill, South Fishermyre and North Fishermyre SOVs; and
- Quadrats FLQ1, FLQ2, FLQ3 and FLQ4.

40.7.4 In addition to the re-survey of SOVs and Quadrats, the following additional area (that was not included within the original survey corridor during the selection of SOVs due to refinement of the route corridor during the 2006 breeding bird surveys) will be surveyed:

- Stranog/Berry Top Hill (NO 864 963) – comprising a mosaic of wet heath, marshy grassland and mixed plantation woodland habitats that potentially offers good foraging and roosting opportunities for breeding birds.

40.7.5 Results of these surveys will be reported a subsequent environmental report in 2007.

Further Surveys in Response to Baseline Results

40.7.6 Further surveys are required in response to the outcome of this assessment process. These are described below.

Water Vole

40.7.7 It is recommended that further surveys are carried out at Fishermyre to monitor this population in order to identify any additional important waterbodies of importance to water voles. Suitable watercourses not showing signs of occupation by water voles may become active given dispersal from the main population. Therefore, watercourses 1-10 will be surveyed each year between 1 May and 1 October until construction commences (it is considered highly unlikely that any other watercourses will be colonised). Water vole surveys should comprise a thorough search for field signs following the methodologies described in Appendix A40.7

(Water Vole) and through the use of tracking stations. The results of these surveys will be used to update the mitigation proposals.

Other Surveys

40.7.8 Due to the scope and technical depth of work undertaken to date, it is considered that no further survey work is required for terrestrial habitats, badger, otter, red squirrel, water shrew, amphibians, brown hare, reptiles, terrestrial invertebrate or wintering birds.

40.8 Residual Impacts

40.8.1 This section describes residual impacts, which are those impacts that are envisaged as remaining following the implementation of mitigation measures. Full details of the residual impacts and mitigation are presented in the appendices to this chapter.

Terrestrial Habitats

Section FL1

40.8.2 Potential residual impacts of Minor significance on terrestrial habitats as a result of fragmentation/isolation and habitat loss would remain in agricultural fields between the A90 and Stonehaven (F1), Megray Wood (F6), Limpet Burn (F7), Fishermyre Wood south (F10) and Fishermyre Wood, and wet habitats to the south of Allochie Croft (F12).

Section FL2

40.8.3 Residual impacts of Minor significance as a result of fragmentation/isolation, habitat loss and disturbance would remain in agricultural fields surrounding Hill of Muchalls (F13).

Section FL3

40.8.4 Residual impacts from fragmentation/isolation and habitat loss would be of Minor significance in wet habitats north of Cookney (F17), Stoneyhill (F19), wet habitats around East Crossley (F21), dry heath/acid grassland mosaic to the west of Wedderhill (F23) and the plantation woodland south of Stranog (F25).

Badger

Section FL1

40.8.5 Minor significant residual impacts as a result of severance and habitat loss would occur around Limpet Burn (F7).

Section FL2

40.8.6 Residual impacts on the local badger population would be reduced to Negligible significance with mitigation.

Section FL3

40.8.7 Residual impacts on the local badger population would be reduced to Negligible significance with mitigation in Section FL3.

Bats

Direct Mortality

40.8.8 Provided that the mitigation measures proposed are successfully implemented and all roosts are located prior to felling and demolition works during construction, the risk of accidental deaths of bats should be prevented. Impacts resulting from RTA during operation of the proposed scheme will be significantly although reduced isolated incidences of RTA may still occur. In addition, it is expected that bats will gradually adapt to the new landscape. The provision of safe crossing points including bridges, underpasses and box culverts combined with the provision of planting at the most sensitive areas will therefore maintain the long term viability of bat populations within the route corridor. The bat populations are unlikely to be compromised and in this respect potential impacts resulting from direct mortality are anticipated to be reduced from high negative magnitude and Minor to Major significance (pending contemplation of the value of the resource) to negligible magnitude and Negligible significance.

Habitat Loss

40.8.9 Bats are vulnerable to impacts arising from habitat loss. It is likely that short to medium term habitat loss (in terms of roosting and foraging habitat) will affect bat populations within the route corridor as newly created habitats are unlikely to provide instant good quality replacement foraging, roosting or commuting opportunities until they mature. The loss of roosting habitat, in particular the loss of tree roosts, in the short-term will be mitigated for by using bat boxes or similar structures. Habitat loss in the long term will be mitigated by new habitat creation and enhancement and provided the mitigation measures are implemented successfully the long term viability of bat populations will not be compromised. These residual impacts are assessed to be low negative magnitude and Minor significance in the short to medium terms and negligible magnitude and Negligible significance in the long term.

Habitat Fragmentation and Isolation

40.8.10 Despite the incorporation of bridges and culverts enhanced by planting to guide bats safely towards crossing points, construction of the proposed scheme would result in short term residual severance of commuting routes and foraging habitat within the route corridor until new habitat has time to mature and bats adjust to these new landscape features. Research has suggested that bats will use these structures even if they are long and narrow (Bach & Limpens, 2004). However, there is potential that proposed culverts greater than 100m in length may not be used by bats, especially when water levels are high.

40.8.11 In the long term, it is expected that bats would gradually find alternative routes and new features along which to echolocate. Woodland habitat creation and the provision of linear habitats will maintain and enhance connectivity between habitat fragments on each side of the road and along its length in the long term. Habitat fragmentation and isolation residual impacts have been assessed as low negative magnitude and Minor significance in the short term and negligible magnitude and Negligible significance in the long term.

Disturbance

40.8.12 Impacts from disturbance of roosts and foraging/commuting areas during construction and initial operation of the proposed scheme will, in the short term, occur. However, these impacts will be significantly reduced through the

implementation of applicable mitigation measures and sensitive phasing of construction works, especially if considerable effort is made to locate roosts prior to works commencing. Long-term disturbance during operation of the scheme is not anticipated to be a significant impact. Light pollution would occur at certain locations be of benefit to foraging bats. The residual impacts of disturbance are therefore predicted to be of Low Negative/Minor in short term and negligible magnitude and Negligible significance in the long term.

Pollution/Other Indirect Impacts

40.8.13 The implementation of measures to prevent pollutants and runoff from entering watercourses or other waterbodies during construction and operation of the proposed scheme is expected to mitigate for all identified impacts. The residual impact assessment has been assessed as negligible magnitude and Negligible significance.

Breeding Birds

40.8.14 Residual impacts on breeding birds throughout Sections FL1-FL3 would remain due to the risk of direct mortality from RTAs, fragmentation/isolation and habitat loss during operation despite application of applicable generic and site specific mitigation. These impacts are assessed as being of Negligible to Minor residual significance.

Otter

Section FL1

40.8.15 At Megray Burn, Limpet Burn and Green Burn, the residual risk of direct mortality is reduced to Negligible significance through the use of otter fencing and provision of culverts with integral mammal ledges and underpasses. With the implementation of mitigation, habitat loss would be reduced to Minor significance and disturbance and potential pollution residual impacts are predicted to be of Negligible significance. Residual impacts of Negligible and Minor significance are predicted with regard to habitat fragmentation at Megray and Limpet Burns. The residual impact of habitat fragmentation at Green Burn is predicted to be of medium negative magnitude and Moderate significance.

Section FL2

40.8.16 At Back Burn, the risk of direct mortality and disturbance is reduced to Negligible significance through the planting of scrub and riparian planting. Habitat loss would likely result in a Minor residual significance at the Burn of Muchalls. Proposed mitigation will minimise potential water pollution, and disturbance. The residual impact of habitat fragmentation and severance during construction is predicted to be of Minor significance, whereas the operational residual impact would be reduced to Negligible significance following mitigation.

Section FL3

40.8.17 The culvert dimensions at the crossing of the Burn of Elsick and Crossley Burn are likely to act as barrier to otter passage and may result in residual impacts of Minor significance from fragmentation and severance of otter territories. Generic mitigation will minimise the risk of pollution and reduce residual impact to Negligible significance. The residual risk of direct mortality and disturbance during construction and operation is of Negligible significance.

Red Squirrel

Section FL1

40.8.18 Although no red squirrels were recorded in Section FL1, they were recorded nearby and therefore it is possible that they are utilising Megray Wood. However, following the generic mitigation proposed, residual impacts on red squirrels in this section are predicted to be of Negligible significance.

Section FL2

40.8.19 No residual impacts are predicted in this section as no red squirrels were recorded.

Section FL3

40.8.20 No residual impacts are predicted in this section as no red squirrels were recorded.

Water Vole

40.8.21 Specific impacts on water voles have only been identified as potentially occurring in Section FL1. Therefore residual impacts are also limited to Section FL1.

Section FL1

40.8.22 Residual impacts of Minor significance on water voles would remain due to habitat fragmentation/isolation, habitat loss and disturbance during construction. The residual impact of habitat loss is predicted to be of Negligible significance in the long-term once the newly created areas of wetland habitat have matured.

Wintering Birds

Section FL1

40.8.23 Residual impacts of Minor significance on wintering birds remain in the area surrounding Limpet Burn (HA F7). Residual impacts are predicted due to temporary fragmentation/isolation and disturbance during construction. Impacts would also occur from the risk of potential direct mortality from RTAs, fragmentation/isolation and habitat loss during operation.

Section FL2 – Section FL3

40.8.24 Residual impacts are predicted to be of Negligible significance on wintering birds in these two sections.

Amphibians, Brown Hare, Reptiles, Terrestrial Invertebrates and Water Shrew

Sections FL1 – FL3

40.8.25 The residual impacts for these species groups would be reduced to Negligible significance through the implementation of appropriate mitigation measures.

Freshwater Habitats and Fish

Section FL1

40.8.26 Residual impacts of Minor significance would occur for Megray Burn, Limpet Burn and Green Burn. Residual impacts would result from direct mortality, habitat loss

and pollution during the construction phase. Residual impacts from direct mortality, habitat loss and disturbance are anticipated to occur during the operation phase.

Section FL2 – FL3

40.8.27 Residual impacts in Section FL2 and FL3 on freshwater habitats and fish would be reduced to Negligible significance.

Table 24 – Summary of Mitigation and Residual Impacts (of Moderate or Above)

Ecological Receptor	Habitat Area	Impact	Magnitude/ Significance	Site-specific Mitigation	Residual Impact Magnitude/ Significance
Section FL1					
Otter	Green Burn, F8	Scheme would cause severance of commuting route between Green Burn and lying up habitat and resources including Fishermyre Moss and Pond, Coneyhatch Burn to the west of the scheme.	High negative/ Moderate	The construction of culverts at crossing points will allow otters to move freely within and between available areas of habitat. However, one of the culverts at this location is approximately 84m long and some otters may be reluctant to use it. Other routes exist.	Medium negative/ Moderate
Section FL2					
There are no residuals impacts of moderate significance or higher in this section.					
Section FL3					
There are no residuals impacts of moderate significance or higher in this section.					

40.9 Post-Project Appraisal

40.9.1 Monitoring is not generally required by law unless it forms part of the conditions for species licence. However, the inclusion of monitoring programmes is vital to provide a 'feedback loop' enabling evaluation of the predictions of the ES, the success of mitigation/compensation measures to be judged and post-development problems to be identified and rectified. As well as these 'project-specific' benefits, monitoring can also provide valuable information for use in future EIAs and for improving the science base of EIAs generally.

40.9.2 Monitoring of mitigation measures (i.e. the effectiveness of culverts and green bridges as mitigation of fragmentation for protected species) will be undertaken for 5 years after completion of the operational phase of the proposed scheme.

40.9.3 An Environmental Management Plan (EMP), although not required by UK EIA legislation, will be used to direct proposed EIA mitigation/compensation measures and monitoring procedures on site. It will include the following:

- prescriptions;
- work programme;
- schedules;
- an appropriate timescale;
- targets;
- monitoring programme;
- mechanism for reviewing the monitoring data; and
- provisions for remedial action if the mitigation/compensation/management targets are not achieved.

40.9.4 An outline EMP will be drawn up in consultation with statutory consultees and is expected to be published in the 2008. The completed EMP will be prepared and submitted to SNH and SEPA prior to construction. The EMP will incorporate Species Management Plans (SMPs) which will include details on habitat management and methodologies to promote long-term conservation objectives of protected species and habitats.

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